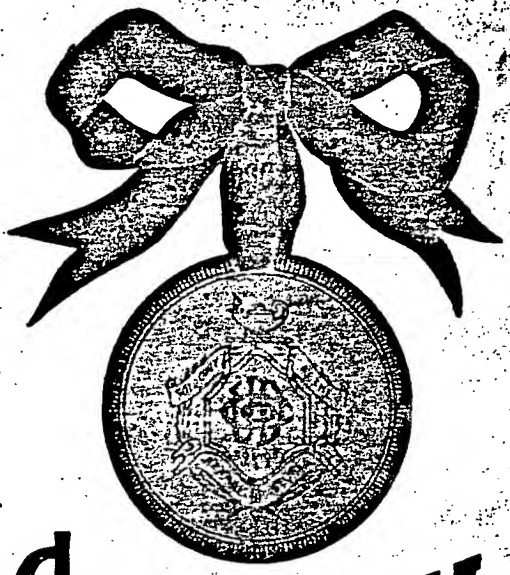
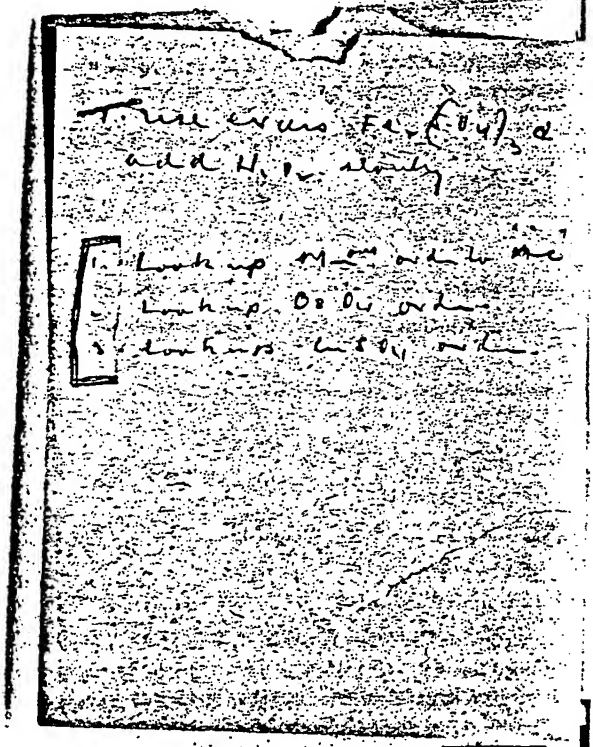


GOLD MEDAL

WRITING TABLET

S 905

Harry Gold



THE GIRDLER CORPORATION
INCORPORATED
VOTATOR DIVISION
GENERAL OFFICES
LOUISVILLE 1, KENTUCKY

December 3, 1947.

A. Brothman and Associates,
Chemical and Mechanical Engineers,
85-03 — 57 Avenue,
Elmhurst, L.I.

Attention: Mr. A. Brothman, Chief Engineer.

Gentlemen:

We have your request for literature on our Votator equipment and are pleased to enclose several circulars and pieces of literature describing the Votator principle of heat transfer and processing and illustrating several models of Votator units designed for different applications. At the present time our general catalog is in the process of revision but will not be issued for several months.

We are forwarding a copy of your letter to our Eastern Sales Manager, Mr. S. N. Welch, located at 150 Broadway, New York City. If, after reviewing the enclosed literature, you wish further particulars, please contact Mr. Welch at the above address.

Thanking you for your interest, we are

Very truly yours,

THE GIRDLER CORPORATION

J. E. Slaughter, Jr.,
Vice President.

JES/cla
encls.

Wherever liquid or viscous materials are processed, consider Votator!

The Votator and Processing Edible Oils

The Girdler Corporation, manufacturers of the VOTATOR, was the *first* to provide equipment for processing margarine *continuously*. Use of the VOTATOR *completely changed the entire method of manufacture* of margarine, with the result that Girdler is considered to have made the greatest single contribution to this industry's production efficiency. In the production of shortening and lard, the VOTATOR is used for chilling and plasticizing, and has also made these operations continuous and much more efficient. Today 75% of the nation's shortening and margarine, and a large and fast-growing percentage of its lard, are VOTATOR-made. In each application, the VOTATOR begins with the prepared hot oils (and other ingredients, if any) and completes the manufacture of the product, delivering it to fillers or molding apparatus.

In these edible oils applications, the VOTATOR has improved the quality, uniformity, texture and color of the product. Moisture condensation and contamination have been minimized. Keeping, creaming, mixing and cooking properties have all been improved, and a more efficient use has been made of everything needed in production — materials, refrigerant, manpower, floor space and power.

The Votator and Processing Petroleum Products

Use of the VOTATOR by the petroleum industry has led to various production short-cuts and new standards of quality, efficiency and safety. The following applications are typical and considerable information, including some pilot plant and plant data, is available:

Grease. A processing system for continuous production of lubricating greases.

Wax. The VOTATOR is an efficient instrument for continuous crystallization and filling of paraffin wax.

Hydrocarbons. Very effective for low temperature crystallization of various hydrocarbons.

Alkylation. A special adaptation, called the VOTATOR Reactor, gives higher yield, higher octane and greater 3-C values in the production of aviation gasoline alkylate.

The Votator and Processing Foods

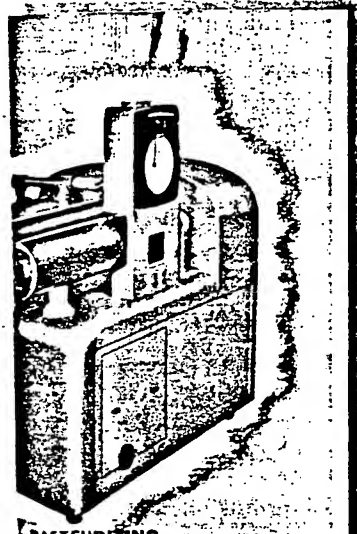
By means of the VOTATOR, *ice cream* production was put on a *continuous* basis. Chilling was accomplished in seconds, which made possible an improved texture of the ice cream and precisely controlled aeration. This application of the VOTATOR has led to numerous others in the chilling of food products, and in all of these uses the above three advantages are of primary importance and outstanding as compared to other methods. The VOTATOR can also be used to cook food products in liquid, viscous or suspended form. Rapid removal of film by surface scraping permits higher temperatures without danger of burning or scorching. In all food processing, The VOTATOR'S closed operation, sanitary construction and easy cleaning are significant.

Other food applications include: *Fruit juices and purees* — quick chilling and crystallization. *Liquid whole eggs* — quick chilling and pasteurization. *Starch base solutions*, such as used in making salad dressings — continuous cooking and cooling.

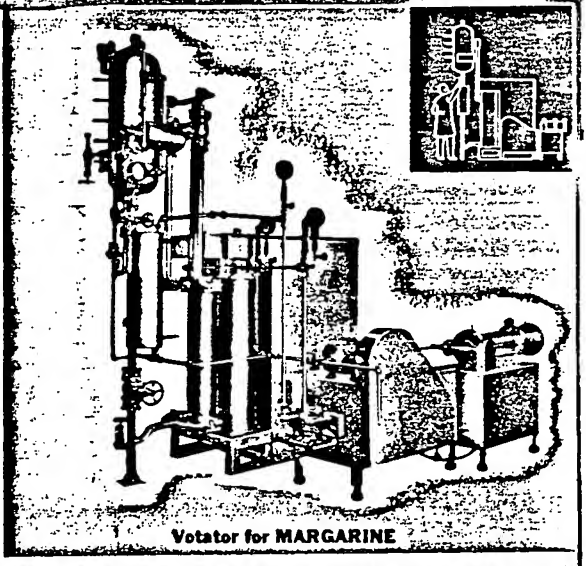
The Votator and Processing Chemicals

The VOTATOR is suitable for processing a wide variety of chemicals that are in liquid or viscous form, at least during one stage of manufacture. The distinguishing feature of each of these applications is *uniform, continuous operation under controlled temperature — continuous mixing, heating, cooling, emulsifying, plasticizing*, etc. Of this broad group, the following are only typical:

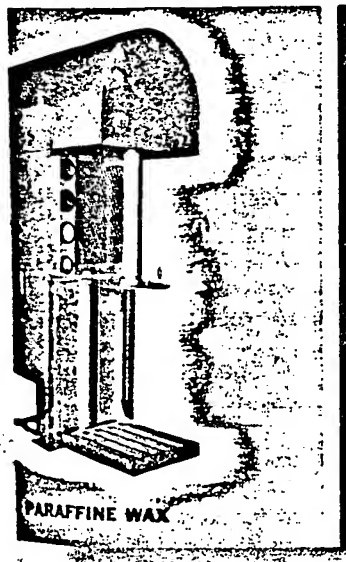
Photographic emulsions — cooling and processing.
Textile printing gums — heating or cooling.
Leather preparations — cooling.
Liquid resins — continuous processing of resins . . . heating and cooling in fluid stage.
Waterproofing compounds — heating or cooling.
Gelatin and glue — heating or cooling.
Paper and textile coatings — uniform mixing with temperature control.
Wax Products — continuous cooling and emulsifying.
Shaving Creams — Chilling and Plasticising.



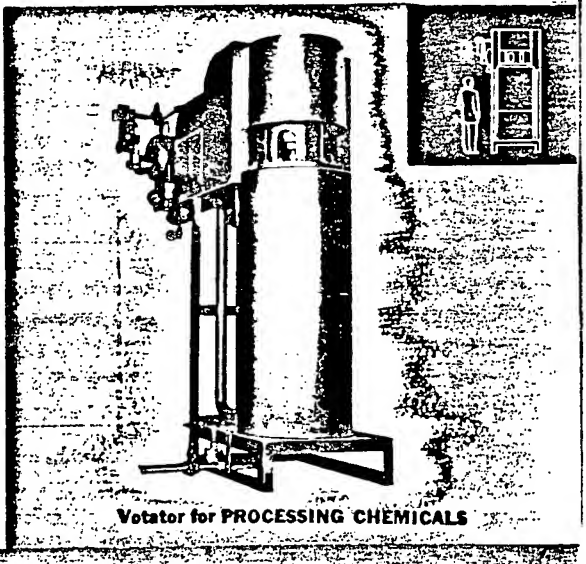
PASTEURIZING



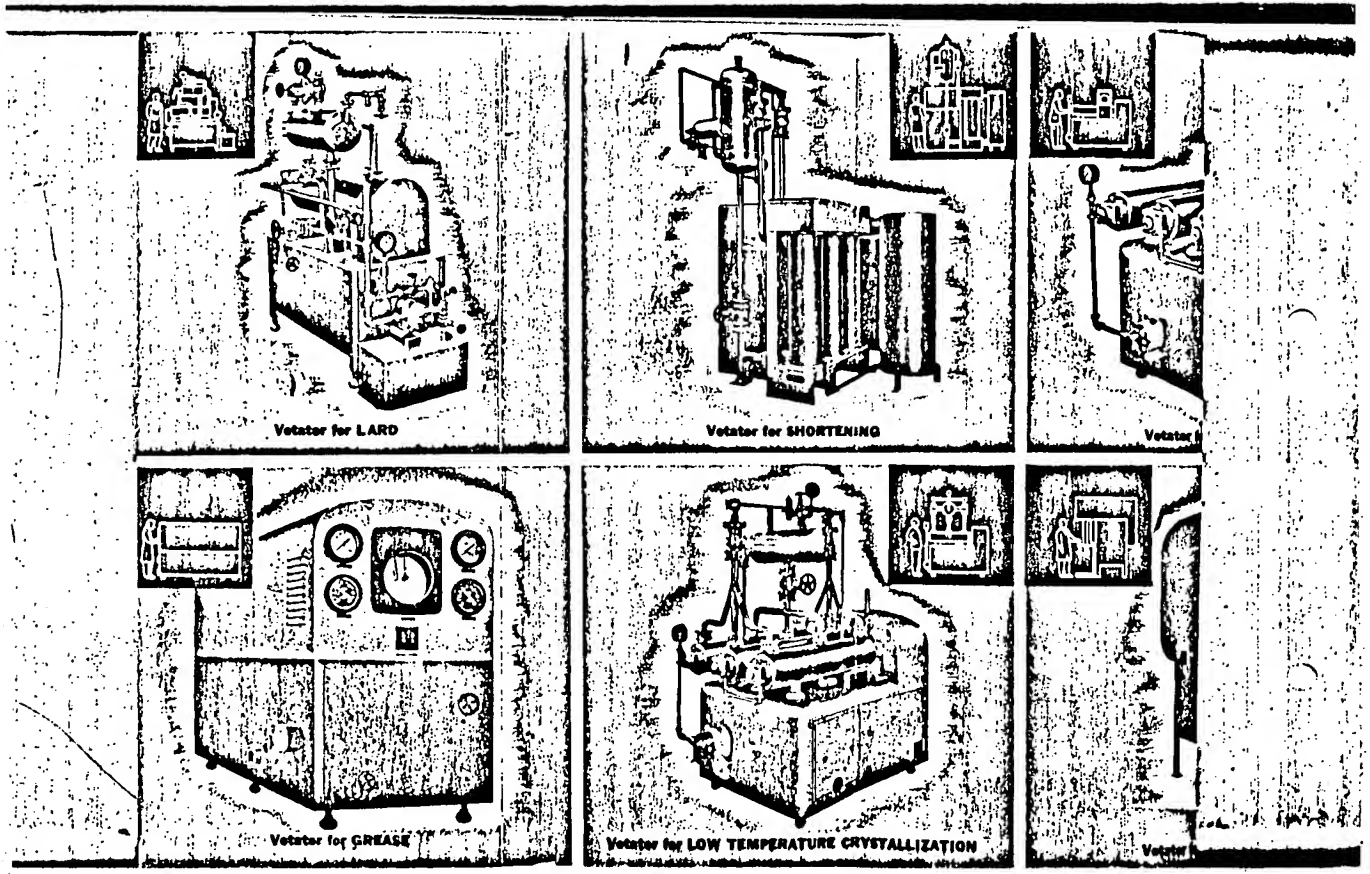
Votator for MARGARINE



PARAFFINE WAX

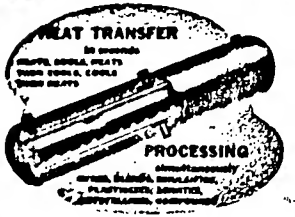


Votator for PROCESSING CHEMICALS


Votator for LARD
Votator for SHORTENING
Votator for GREASE
Votator for LOW TEMPERATURE CRYSTALLIZATION

Votator

CONTROLS UNIFORMITY AND PRODUCTION EFFICIENCY IN MANY INDUSTRIES!



THE VOTATOR processes virtually any liquid or viscous material, including the heavier viscous substances and those that tend to adhere to heat transfer surfaces or are otherwise difficult to handle with conventional equipment. For this reason and also because the continuous, closed, controlled operation improves the quality of the finished product, its application is being rapidly extended into many fields. The VOTATOR has had commercial applications in heating the product to more than 600°F and cooling the product to -70°F.

VOTATORS are built in a wide range of sizes to meet either large or small capacity requirements. VOTATOR equipment can be furnished in either carbon steel or special corrosion-resisting materials. Specific data on particular applications available on request.

6/6-150

TYPICAL Votator UNITS

Reprinted from INDUSTRIAL AND ENGINEERING CHEMISTRY, Vol. 36, Page 522, June, 1944

HEAT TRANSFER in the VOTATOR

A. Q. Moulton
THE GIRDLER CORPORATION, LOUISVILLE, KY.

Over-all coefficients of 500 to 1150 B.t.u./(hour) (square foot) (° F.) are easily obtainable on water-to-water heat interchange using the Votator. High agitation combined with scraping of the heat transfer wall produces thin films and high turbulence. The result is high rates of heat transfer even though the linear velocity through the Votator is less than 0.1 foot per second. This internal design leads to small size equipment which, in turn, allows high jacket velocities with low pressure drops. The Dittus-Boelter equation is used to calculate film coefficients on the jacket side where the flow is helical. The coefficients thus obtained check the experimental results within 10%. Film coefficients on the Votator side are found to increase less rapidly above a blade peripheral velocity of 13 feet per second for waterlike materials in the particular Votator design used.

THE Votator has been used extensively for processing margarine, shortening, and lard, because crystallization, plastization, emulsification, and heat transfer may be brought about simultaneously. Its main accomplishment is processing, so that little stress has been put on the high heat transfer efficiency of the Votator. This paper deals with a water-to-water heat interchange test in which blade velocity, jacket-water velocity, and throughput rates were studied in relation to the over-all and film heat transfer coefficients.

A laboratory Votator, 8 inches in diameter and equipped with a 2.25-inch diameter shaft and two stainless steel blades, was designed for use with both water and ammonia. For water a sleeve insert cuts the height of the annular space to $^1/_8$ inch, and a baffle seal at one end prevents by-passing the water flow through the ammonia section. Copper tubing ($^1/_4$-inch diameter) inside the sleeve forms a helical water path around the nickel Votator tube. This method is apparently satisfactory since the heat balance—i.e., the quantity of heat flowing as measured from the jacket and Votator sides—checked to less than 2% for most cases. The assembly of this unit is shown in Figure 1.

The method consisted in pumping hot water (175° F.) at about 560 pounds per hour through the Votator and cooling it with a countercurrent flow of cold water (60° F.) on the jacket. Speeds of the mutator (a shaft with blades) were 200, 400, 500, 700, 1000, and 1900 r.p.m. Jacket-water velocities of 4.7, 5.1, 6.5, 7.5, 9.8, 12.9, 18.1, and 25.9 feet per second were tried. These corresponded to pressure drops through the jacket of 0.8, 1, 2, 3, 5, 10, 20, and 40 pounds per square inch. In two cases, 1900 and 400 r.p.m., the throughput rate was changed from 560 to 340 and 1800 pounds per hour, respectively. In all cases calibrated thermometers (0.2° F. subdivisions) were used, and the water rates were determined with a stop watch and scale tank. Thirty pounds of votated water and 86 pounds of jacket water were weighed. Check readings were made to ensure that the equipment had come to equilibrium. The mutator speed was less accurate since the speed indicator could not be reliably read better than ±10 r.p.m.

Three points should be considered for accurate analysis of the data—errors due to (a) movement in stagnant layer of water outside the sleeve insert, (b) any flow by-passing from one helical turn to the next, and (c) expansion and contraction losses at entrance and exit of jacket. This work neglects these errors since they are small and are apparently within the accuracy of the data—namely, 2%.

HEAT BALANCE

The quantity of heat flowing per hour was determined by multiplying the average specific heat by the weight rate of water flow and the temperature change of the water. This change in heat content of water flowing through the Votator and jacket were separately calculated; values checked in most cases to less than 2%. The correction for average specific heat was found unnecessary with the present accuracy.

Table I summarizes the data. Figure 2, constructed from the data of Table I, shows how the quantity of heat flowing, Q, varied with changes in mutator speed for several jacket-water (jw) velocities. It illustrates that the amount of heat flowing through the 0.7 square foot of cooling surface reached as high as 52,000 B.t.u. per hour, with 37,000 B.t.u. as about the average flow. Increased mutator speed increased the heat flow considerably, but the increase at the higher mutator speeds was much smaller, as shown by the following data taken at a jacket-water velocity of 9.3 feet per second (ΔP = 5 pounds per square inch, 2900 pounds per hour):

Mutator Speed, R.P.M.	B.T.U. Removed per Hour	Mutator Speed, R.P.M.	B.T.U. Removed per Hour
300	32,750	700	37,800
500	34,800	1000	38,800

In going from 300 to 500 r.p.m., 2050 B.t.u. per hour more could be removed; in going from 700 to 1000 r.p.m., the increase was less than half as much, 1000 B.t.u. per hour. Obviously there should be a selection of the highest mutator speed which is consistent with power load, tube, blade, and bearing wear.

Black dots in Figure 2 indicate the few cases where the heat balance did not check closely. For this reason the values obtained from the votated water side were used where the data were more reliable, since low rates and large temperature differences existed. By this procedure the curves became consistent with one another throughout all this work. Other points on the graph are an average of the data obtained from the jacket and Votator sides.

The bottom curve at a jacket-water velocity of 5 feet per second is smooth, but all other curves show a sharp break at 500 r.p.m. Also, the greatest increase in heat transfer for jacket-water velocities, 9 feet per second and above, occurred in going from 500 to 700 r.p.m.; at 5 feet per second the sharpest increase occurred at 300 to 500 r.p.m. The facts are explained later where it is more clearly shown that full turbulence apparently does not occur until a jacket-water velocity of 7.5 feet per second is obtained.

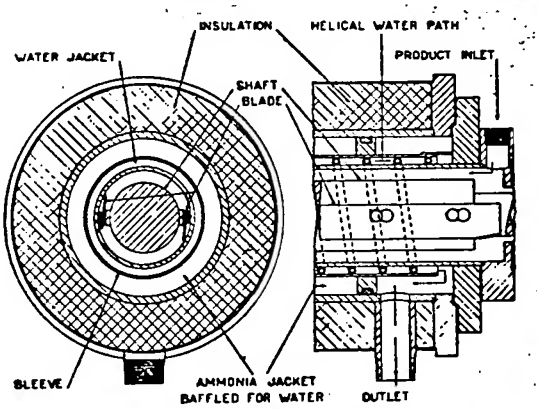


Figure 1. Longitudinal and Cross-Sectional View of Ammonia-Jacketed Laboratory Votator Baffled for Water

Table I. Data for Water-to-Water Heat Transfer

Temperature, °F. Vot. outlet	Jacket out	Vot. inlet	Jacket in	LMTD	Rate, Lb./Hr. Vot. outlet	Jacket	Heat, B.T.U./Hr. Vot. outlet	Jacket	ΔP, Jacket	U
300 Revolutions per Minute										
177.2	67.2	113.1	62.8	76.21	884.4	8158	27,410*	33,850	60	700*
178.3	69.9	116.1	63.8	77.94	5844.2	5412	34,300*	34,780	20	663*
179.0	71.5	119.2	63.8	79.21	881.7	2993	34,740	34,680	10	636
179.5	74.0	122.7	63.8	80.55	877.1	2280	32,750*	33,220	5	581*
179.8	76.8	134.6	63.0	80.62	883.5	2292	31,730	30,430	2	563
179.9	80.9	128.7	64.7	80.25	881.4	1802	29,340	28,830	1	518
400 Revolutions per Minute										
179.8	71.9	148.9	63.7	86.41	1780	5649	54,430	51,900	20	782
178.8	69.8	111.4	62.8	74.85	878.1	5594	33,580	37,990	30	736
179.3	81.9	136.0	63.9	78.82	881.5	1617	30,910	30,500	1	556
500 Revolutions per Minute										
179.4	66.8	103.1	62.8	67.83	555.3	8043	40,640	40,160	60	851
178.6	70.5	106.2	63.8	69.44	559.3	5721	29,220	33,230	20	708
178.4	72.8	110.0	63.8	71.09	553.3	4060	26,690	26,490	10	737
177.3	75.8	114.2	63.8	72.06	555.3	2192	24,990	24,760	5	682
177.4	77.4	116.4	64.0	73.66	552.3	2457	23,650	23,870	2	645
177.2	79.9	119.2	64.0	74.22	555.3	2039	23,170	23,360	2	621
177.7	83.2	121.9	64.2	75.01	559.3	1712	21,980	20,760	1	560
700 Revolutions per Minute										
179.4	68.1	100.5	63.0	67.83	866.5	8096	44,630*	41,940	60	940*
178.0	70.1	103.4	63.6	68.83	862.3	5780	41,880	42,070	20	871
176.8	72.5	106.9	63.8	69.92	865.3	4060	39,450	39,320	10	806
179.0	75.0	113.2	63.8	72.93	868.9	2274	37,780	37,870	5	741
178.2	78.8	114.8	63.0	73.21	859.2	2215	34,490	35,250	2	691
178.4	83.0	120.2	63.1	74.86	859.3	1634	33,520	33,250	1	630
177.6	84.8	121.6	63.8	74.87	856.3	1466	31,220	31,140	½	563
1000 Revolutions per Minute										
179.6	70.5	102.1	62.5	68.54	863.7	5648	44,410	43,110	20	933
179.4	73.0	105.6	63.5	70.03	865.3	4044	41,670	42,400	10	858
178.5	75.0	109.5	63.6	71.41	863.3	2958	38,840	39,710	5	786
178.6	78.6	113.6	63.6	73.74	869.4	2329	36,970	37,200	2	728
178.6	84.1	119.7	63.7	76.15	866.3	1569	33,330	33,500	1	643
1900 Revolutions per Minute										
178.8	63.7	90.5	56.8	66.08	889.3	7485	51,640	51,630	60	1118
177.5	65.6	93.8	56.8	67.43	871.7	5347	48,050	48,090	20	1018
176.5	69.1	100.0	56.7	70.84	863.4	3633	43,020	49,890	10	890
176.0	61.1	75.7	56.8	51.33	833.5	7506	31,400*	32,650	60	672*
176.5	63.1	79.4	56.8	54.40	827.1	5413	30,640*	34,080	20	806*
171.5	66.1	85.0	56.9	58.56	843.9	3662	30,560*	33,670	10	746*

* Over-all coefficient U based on heat

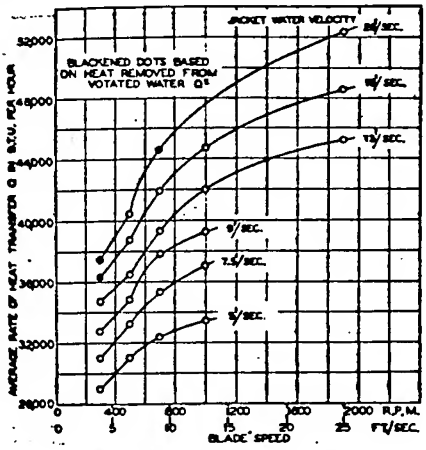


Figure 2. Effect of Blade Speed on Heat Transfer for Several Jacket Conditions

The data at 1900 r.p.m. do not fall on the 26, 18, and 13 foot per second lines. The correct velocities for these are 24, 17, and 11.6 feet per second; consequently, extrapolated values are included in Figure 2 to make the picture complete.

To simplify calculations on the jacket side, an over-all average was made of the average jacket temperatures obtained at various pressure drops. The inlet and outlet jacket-water temperatures were averaged for each Votator condition. Since these averages were quite close for different conditions on the Votator side, they were again averaged (Table II) in order to calculate the physical properties of the jacket water as given in Table III.

A plot of variation in transfer of heat with changes in *jw* velocities for the several mutator speeds showed that, up to 9 feet per second, the heat transfer increased linearly with increased velocity; above this value the increase tapered off. At a mutator speed of 700 r.p.m., 3700 more B.t.u. per hour were transferred in going from a *jw* velocity of 5 to 8 feet per second; in going from 20 to 23 feet per second, the increase was only 2100 B.t.u. per hour. Even the latter amount is considerable, so it is advisable to use the highest *jw* velocity possible and economical with the water pressure available.

Table III indicates that at 300–1000 r.p.m. a velocity of 25 feet per second required 8000 pounds of water flow per hour and a pressure drop of 40 pounds per square inch. Unless the water is to be used later at low pressure for further processing, these conditions are impractical without a booster pump. Values above 9 feet per second should be used in all possible installations where the amount of transferred heat increases at its maximum rate up to this point.

Table II. Inlet and Outlet Jacket-Water Averages

Jacket Pressure Drop, Lb./Sq. In.	Av. Jacket-Water Temp., ° F. 300 r.p.m.	500 r.p.m.	700 r.p.m.	1000 r.p.m.	Over-all Av. Jacket Temp., ° F.
60	65.0	66.3	65.6	..	65.6
50	65.9	67.2	66.5	66.5	66.6
40	67.3	68.5	67.7	67.5	67.6
30	68.4	69.7	69.4	69.3	69.3
20	69.7	70.7	70.7	70.6	70.4
10	..	71.5	..	..	71.6
1	73.0	73.3	73.1	73.4	73.5
0.5	..	..	74.0	..	74.0

OVER-ALL COEFFICIENTS

The over-all coefficients were calculated from the average quantity of heat flowing, Q, by the following equation:

$$Q = UA_s LMTD \qquad (1)$$

The amount of heat being transferred per hour, Q, is proportional to the cooling surface area, A_s, and the driving force, $LMTD$.

Cooling area A_s was 0.7 square foot of scraped surface for our unit. This figure was based on the assumption that the flanged heads of the jacket (Figure 1) were only half effective for cooling and that the cooling space occupied by the helical baffle was negligible. Certainly the cooling area will not be appreciably larger than this, and if the baffle does effectively occupy space, the calculated over-all coefficient, U, is on the conservative side. The over-all coefficients were calculated on the basis of effective scraped surface.

Effect of Mutator Speed. The effect of mutator speed in the range 300–1900 r.p.m. on over-all coefficient U is shown in Figure 3. In contrast to the heat quantity curves (Figure 2), these curves are smooth and do not show the pronounced break at 500 r.p.m. Here, as previously discussed, the points at 1900 r.p.m. are extrapolated values. The largest U obtained was about 1140 B.t.u./(hour)(square foot)(° F.), and the average was close to 800. The most rapid change in U occurred at the lower speeds.

The increase in U slowed down after 600 r.p.m. It would obviously be poor efficiency to operate below 600 r.p.m. for thin liquids, and as discussed in the section on Heat Balance, it is advisable to use the highest mutator speed consistent with wear and power. The peripheral speed at 600 r.p.m. was 7.8 feet per second. As a result of the high over-all coefficient U obtained by scraping, the size of equipment is small, and high jacket-water velocities and film coefficients can be obtained with small pressure drops.

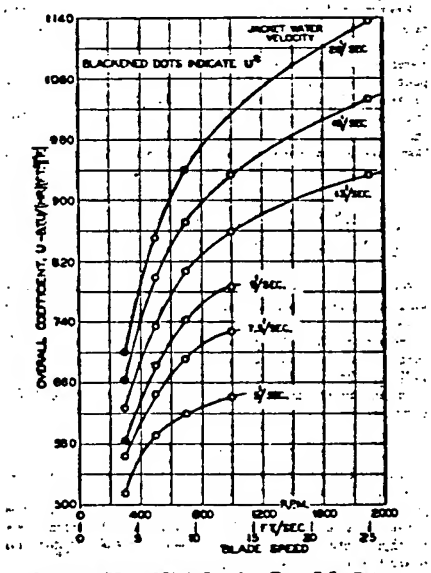


Figure 3. Effect of Blade Speed on Over-all Coefficient of Heat Transfer for Several Jacket Conditions

Table III. Jacket Average Data

(Annular space = 1.895×10^{-3} sq. ft., equivalent diameter $D_e = 0.0234$ ft.)

Pressure drop, lb./sq. in.	Av. temp., °F.	Av. rate, lb./hr.	G, lb./sq. ft./sec.	Density, lb./cu. ft.	Viscosity, centipoises	V, ft./sec.	R_e
300–1000 R.P.M.							
40	86.6	8096	1612	62.3	1.036	26.88	75,000
20	86.6	8664	1726	62.39	1.024	28.10	83,400
10	87.8	4038	804.3	62.28	1.012	13.91	38,800
5	89.2	2921	581.6	62.27	0.997	9.23	33,900
3	270.4	2247	447.3	62.26	0.972	7.31	22,900
2	71.6	2039	405.9	62.24	0.956	6.52	21,100
1	72.6	1591	316.8	62.24	0.943	5.09	17,000
½	74.0	1455	291.7	62.22	0.929	4.69	15,000
1900 R.P.M.							
580	40	80.25	7435	22.9			
	20	81.1	5347	17.09			
	10	83.9	3627	11.6			
340	40	89	7506	24.39			
	20	80	5413	17.9			
	10	82.9	3662	11.75			
	5	83.6	2540	8.13			

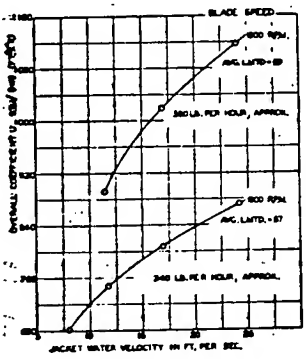


Figure 4. Effect of Changes in Rate and Temperature of Votated Water on Over-all Coefficient

Effect of Changes in Conditions on Votator Side. The rate of votated water was varied in two cases. At 1900 r.p.m. about 580 and 340 pounds per hour were tried at three jacket-water velocities (Figure 4). At 400 r.p.m., rates of 1800 and 560 pounds were used. The data are given in Table I. Figure 4 shows the difference in over-all coefficient obtained. In addition to a change in throughput rate, the log mean temperature difference varied. The following data for 340 pounds per hour were based on the heat change of the votated water, Q_v, since the heat change of the jacket water, Q_j, was inconsistent and erratic:

$LMTD$	Rate, Lb./Hr.	Mean Votator Temp., °F.	Votator Speed, R.P.M.	Q	U
68	570	60	1900	48,000	1016
84	340	89	1900	30,600	806

Since the jacket-water temperature and velocity were about equal, the film coefficient would be about the same in the two cases. Consequently, the change had to do with a difference in phenomena on the Votator side. The log mean temperature difference decreased about 20%. The heat load dropped about 36%, and the over-all coefficient was lowered about 20%. The log mean temperature difference is the main contributing factor, as would be expected.

Film Coefficients

Film coefficients on the Votator side and jacket side were calculated. It is well known that the heat transfer is mainly dependent on the rate at which the heat can be transferred across the stagnant films which lie close to the metal. Although only a few thousandths of an inch thick, these films act as insulators and retard the flow of heat.

The heat Q which is transferred per unit time from the Votator to the jacket must flow through each resistance (1) Votator water film, (2) metal, and (3) jacket-water film. The heat equation is then

$$Q = h_v A_v (t_v - t_{vm}) \quad (2A)$$

$$Q = h_m A_m (t_{vm} - t_{mj}) \quad (2B)$$

$$Q = h_j A_j (t_{mj} - t_j) \quad (2C)$$

Proportionality constants h_v, h_m, and h_j apply to Votator water, metal, and jacket-water film, respectively; t_v, t_{vm}, t_j, and t_{mj} apply to temperature of votated water, metal surface on Votator side, jacket-water, and metal surface on jacket side, respectively. The area stays constant. This is an arbitrary assumption because U is based on the Votator side; this means only that the h values, even though applying to different films, are based on the area of the inside scraped surface. To convert to the outside area—e.g., $Q = h_v A_v (t_{vm} - t_j) = h_j A_j (t_{mj} - t_j)$. Then

$$h_v A_v = h_j A_j \quad (3)$$

From Equation 2,

$$Q = \frac{\Delta t A_v}{\frac{1}{h_v} + \frac{1}{h_m} + \frac{1}{h_j}} \quad (4) \qquad \frac{1}{U} = \frac{1}{h_v} + \frac{1}{h_m} + \frac{1}{h_j} \quad (5)$$

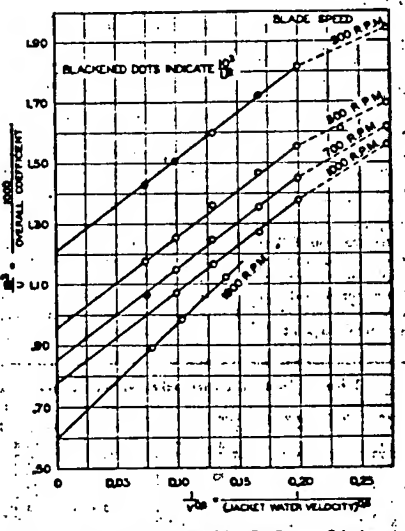


Figure 5. Reciprocal Plot for Film Coefficient Calculation

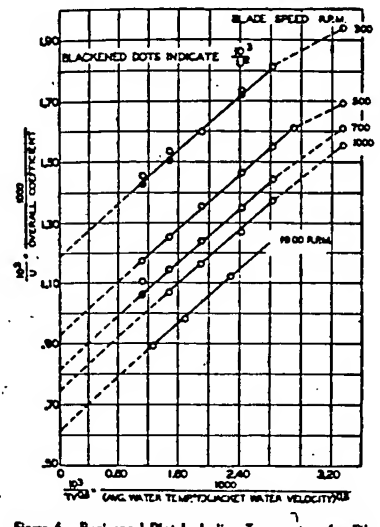


Figure 6. Reciprocal Plot Including Temperature for Film Coefficient Calculations

The coefficient for metal equals the thermal conductivity divided by the thickness of metal,

$$h_m = k/l \qquad (6)$$

and may be replaced in Equation 5.

JACKET-WATER COEFFICIENT h_j. Empirically it has been shown (1, 2, 3) that in flow of water through pipes the film coefficient varies as the 0.8 power of velocity. Inside the Votator there are conditions which differ considerably from flow through a pipe, but in the jacket these conditions are fairly representative. This method was tried to calculate the jacket water film coefficients.

Maintaining a constant mutator speed should keep the Votator film coefficient, h_s, approximately constant, and $1/h_f$ should vary with $1/U$ (Equation 5); since it was shown that h_f varies with $V^{0.8}$, a plot of $1/U$ against $1/V^{0.8}$ should give a straight line for any given mutator speed. Substituting in Equation 5,

$$\frac{1}{U} = \frac{m}{V^{0.8}} + \left(\frac{1}{k_s} + \frac{1}{k_m/l}\right) \qquad (7)$$

A plot of $1/U$ against $1/V^{0.8}$ is given in Figure 5. A straight line does result so that the assumption of constant h_s is justified. With the exception of 1900 r.p.m. the lines are parallel. The slope is 0.00303 and the jacket-water film coefficients h_j is, therefore, easily calculated.

There is about 5° F. difference in the jacket water used at 1900 r.p.m. and that for the data at 300–1000 r.p.m. This accounts in part for a difference in slope in these two sets of data. If no difference in slope had been obtained, it would have been concluded that temperature did not affect the jacket-water film coefficient, which is known to be false. The slope in this case is 0.00377. The intercepts of these lines from Figure 5 are:

R.P.M.	Intercept	R.P.M.	Intercept
[illegible]	1.308×10^{-3}	2000	0.775×10^{-3}
[illegible]	0.915×10^{-3}	1900	0.567×10^{-3}
[illegible]	0.833×10^{-3}		

The jacket-water film coefficient is calculated from

$$h_j = m/V^{0.8} \qquad (8)$$

Applying this method of calculation, the following results are obtained:

300–1000 R.P.M.				1900 R.P.M.			
Velocity of j_w, ft./sec.	Av. j_w temp., ° F.	h_{j_o}	h_M	Velocity of j_w, ft./sec.	Av. j_w temp., ° F.	h_{j_o}	h_M
25.9	65.6	4110	4450	23.9	60.2	2350	
18.1	66.6	3100	3260	17.1	61.6	2570	
13.9	67.8	2350	2550	11.6	62.9	1880	
9.3	69.2	1820	1972				
7.5	70.4	1580	1660				

Below a velocity of 7.5 feet per second the curve is no longer straight, and this method no longer applies. The black dots of Figure 5 do fall on the straight line so that the previous use of these values was justified. Since Equation 8 holds only in the turbulent region, it must be concluded that complete turbulence starts around 7.5 feet per second in the jacket of this Votator. From this work there appears to be a transition range in turbulence since Reynolds numbers were high (16,000) even when the jacket water velocity was 4.7 feet per second.

Since the temperature of the jacket water was different for the values at 1900 r.p.m. as compared to those at 300–1000, $1/U$ was plotted against $1/TV^{0.8}$ in order to find out if the values at 1900 r.p.m. would fall into line (Figure 6). The 1900 r.p.m. points fall on a straight line parallel to the others. Therefore we are justified in correcting the value of h_j for temperature differences. The slope is 0.221. The film coefficients thus calculated were used in all later work:

300–1000 R.P.M.			1900 R.P.M.		
Velocity of j_w, ft./sec.	h_{j_o}	h_M	Velocity of j_w, ft./sec.	h_{j_o}	h_M
25.9	3760	4075	23.9	2150	
18.1	2840	2980	17.1	2080	
13.9	2190	2370	11.6	1680	
9.3	1720	1872			
7.5	1480	1600			

Comparison of this table with the one above shows that h_j (300–1000 r.p.m.) decreased about 10% when the temperature correction was applied.

VOTATED WATER COEFFICIENT h_s. The film coefficient on the scraped surface may be calculated by substituting in Equation 6 or 7. Equation 7 gives the following results:

Mutator Speed, R.P.M.	Peripheral Speed, Ft./Sec.	h_s for Scraped Surface, Fig. 6	Fig. 6	Temp. of j_w ° C.
300	3.93	1080	1110	
500	6.54	1490	1550	Approx. same
700	9.16	1760	1870	
1000	13.1	2030	2160	
1900	24.8	2200	2030	Approx. 5° lower

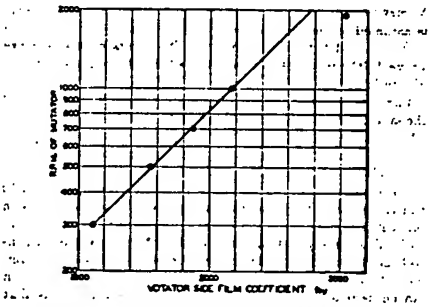


Figure 7. Relation between Blade Speed and Film Coefficient

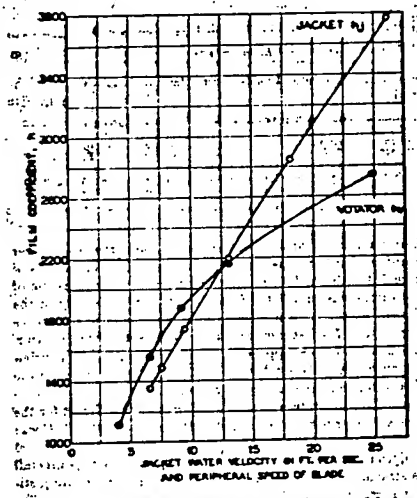


Figure 8. Effect of Velocity on Film Coefficients of Jacket and Scraped Side

The results from Figure 6 are plotted in Figure 7. The latter shows that the relation between film coefficient and mutator speed may be expressed by a straight line on semilog paper when jacket conditions are approximately the same. The equation is:

$$\log (\text{r.p.m.}) = mh_i + \log (\text{intercept}) \qquad (9)$$

$$= \frac{(0.475)h_i}{1000} + \log 87.5$$

The 1900 r.p.m. point falls to the right of the line; this may be due to the fact that the mean temperature of the votated water (147° F.) was lower than that for the 300–1000 r.p.m. points (145° F.). Apparently, when thin liquids are used, a lower mean temperature inside the Votator leads to a higher film coefficient. This is unexpected, since, in general, with other heat transfer equipment the film coefficient increases with higher temperatures. The reason may be that the scraping force of the blade is more effective as the viscosity increases. The most effective equation for h_i is to express it as a function of the properties of the material processed; future work will attempt to set up such an equation.

Comparison of h_i and h_j. It is interesting to see how h_i and h_j vary for a given linear velocity. In the case of h_i the velocity is assumed to be that of the tip of the blade. Figure 8 is a plot of h_i and h_j against velocity. The points on the h_i curve above 1000 r.p.m. are obtained from the extrapolated curve of Figure 7.

Figure 9 was constructed from Figure 8 by reading h_i and h_j at the same abscissa. The equation of this line is:

$$\log h_j = mh_i + \log b \qquad (10)$$

$$m = 0.338/1000; \; b = 324$$

Thus when h_j is known, h_i can be calculated from Equation 10 and vice versa. The effect of changes in operating conditions on this curve is not known. Equation 10 at first appears to have no immediate application, since to determine h_j would, in general, give the experimental means for obtaining h_i. However, the following section shows that the Dittus-Boelter equation can be used to obtain h_j and thus obtain h_i on the basis that Equation 10 holds for other operating conditions.

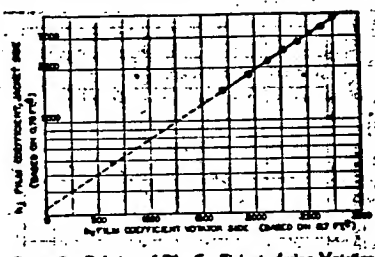


Figure 9. Relation of Film Coefficients during Votation

h_j by Dittus-Boelter Equation. Dittus and Boelter (*1*) were able to show that, for a wide variety of materials (e.g., air and water) flowing in turbulent motion, the film coefficient of heat transfer could be represented by the empirical equation,

$$hD/k = 0.0225(Re)^{0.8}(Pr)^{0.4}$$

where D is the diameter of the pipe; in the case of the Votator jacket it is D_e, the equivalent diameter of the rectangular helix.

The following table summarizes the different water velocities used in the Votator jacket and compares them to the values of h_j obtained from Figures 5 and 6:

Velocity, Ft./Sec.	ΔP	h_j from U (Fig. 5)	h_j from U (Fig. 6)	h_j from D. & B. equation
24.9	40	4110	3700	4380
16.1	20	3100	2840	3130
12.9	12	2550	2190	2430
9.2	6	1830	1720	1880
7.3	3	1530	1420	1530

The results are in good agreement. A fairly accurate estimation is therefore available of h_j and of h_i from Equation 10; or if the over-all coefficient has been determined, h_i can be more accurately obtained from Equation 5. Also the calculated h_j falls closer to h_{j_e} obtained from Figure 5 than from Figure 6. This is, however, no criterion of selection since A_i is not known with sufficient accuracy, and h_{j_e} could easily vary by 10%.

Different Votating Conditions. The data graphed in Figure 4 for two throughput rates (340 and 580 pounds per hour) at 1900 r.p.m. can be treated similarly by the methods outlined. These data are plotted in Figure 10 for $1/U$ against $1/V^{0.8}$. Here, as previously, the lines are not parallel when $1/U$ is plotted against $1/V^{0.8}$ since the jacket water temperatures were different. The method of dividing by temperature again shows its merit since the slope for the two rates, even though of different jacket-water temperatures, became the same. From Figure 10, the corrected film coefficients are as follows:

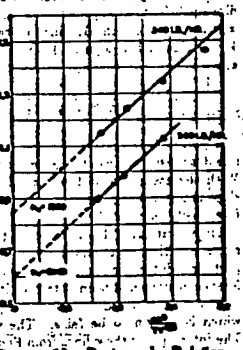


Figure 10. Reciprocal Relation Comparison, Including Temperature, of Different Votating Conditions for Film Coefficient Calculation

340 Lb./Hr., h_o = 1800

Av. j_w temp., ° F.	V of j_w, ft./sec.	h_{j1}, Fig. 10
58	34.35	2410
60	17.0	2620
61.5	11.75	1990
63.6	8.13	1540

580 Lb./Hr., h_o = 3140

Av. j_w temp., ° F.	V of j_w, ft./sec.	h_{j1}, Fig. 10
60.3	23.9	3580
61.6	17.08	3080
62.9	11.6	1980

Even though the average temperature inside the Votator is considerably different, this alone does not seem to explain the marked change in h_o with change in rate. Further work is necessary to clarify this point.

SUMMARY

1. A good average over-all coefficient is about 800 B.t.u./(hour) (square foot) (° F.). The coefficient varies as follows:

Mutator Speed, R.P.M.	Velocity of j_w, Ft./Sec.	Over-all Coefficient U
800	5	830
1800	24	1130

2. A minimum jacket-water velocity of 7–10 feet per second and a minimum mutator speed of 600 r.p.m. (7.8 feet per second) should be used for efficient operations on waterlike materials. Values greater than these are beneficial and should be used if other factors such as power load, jacket-water pressure drop, blade and tube wear, do not make the operation uneconomical.

3. The film coefficient on the jacket side varies about as follows:

Velocity of j_w, Ft./Sec.	h_j, B.T.U./(Hr.)(Sq. Ft.)(° F.)
7.5	1800
25	4100

4. The film coefficient in the votated water side varied about as follows:

Mutator Speed, R.P.M.	Peripheral Speed, Ft./Sec.	h_o, B.T.U./(Hr.)(Sq. Ft.)(° F.)
300	3.9	1100
1000	13.1	2300

5. The Dittus-Boelter equation can be used to calculate the film coefficient on the Votator jacket, even though the path is helical. The results check experimental values within 10%.

ACKNOWLEDGMENT

The author wishes to thank Bruce E. Adams for his help with the calculations and figures presented here.

NOMENCLATURE

A_s = cooling surface area, sq. ft.
D_e = equivalent diameter of jacket based on rectangular section
G = mass velocity, lb./sq. ft./sec.
h = film coefficient of heat transfer, B.t.u./(hr.)(sq.-ft.)(° F.)
h_{j1} = jacket-water film coefficient based on inside area on heat transfer wall
h_{j_o} = jacket-water film coefficient based on outside area of heat transfer wall
h_m = metal wall expressed as film coefficient
j_w = jacket water
$LMTD$ = log mean temperature difference, ° F.
l = thickness of metal
Mutator = shaft with scraper blades
ΔP = pressure drop through water jacket, lb./sq. in.
Pr = Prandtl number = $c_p\mu/k$
Q° = heat transferred, based on heat removed from votated water, B.t.u./hr.
Re = Reynolds number = DG/μ
T = temperature, ° F.
U° = over-all coefficient based on Q°, B.t.u./(hr.)(sq.-ft.)(° F.)
V = velocity, ft./sec.

* See footnote Table I.

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(1) Dittus, F. W., Boelter, L. M. K., *Univ. Calif. Pub. Eng.*, **2**, 443 (1930).
(2) McAdams, W. H., Sherwood, T. K., and Turner, R. L., *Trans. Am. Soc. Mech. Engrs.*, **48**, 1233 (1926).
(3) Wilson, E. E., *Ibid.*, **37**, 47 (1915).

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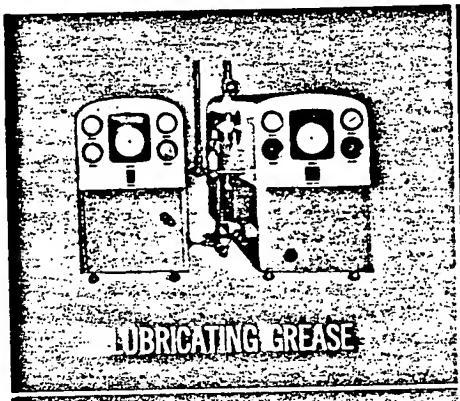
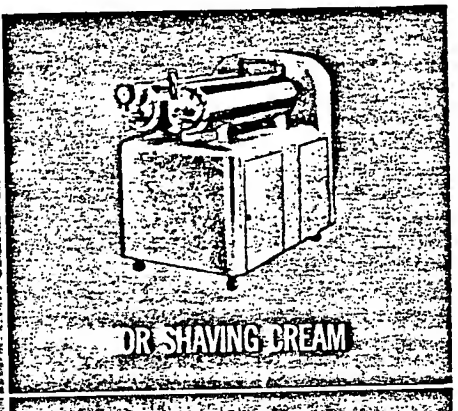
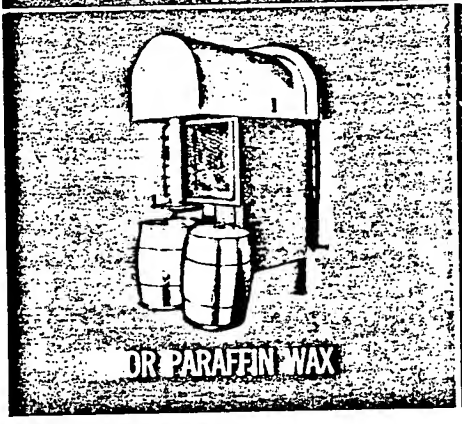
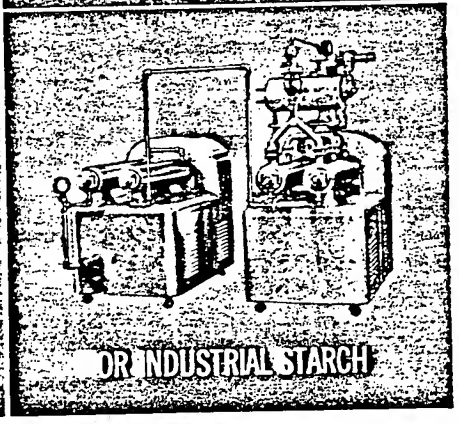








OR What viscous material can you process more profitably?

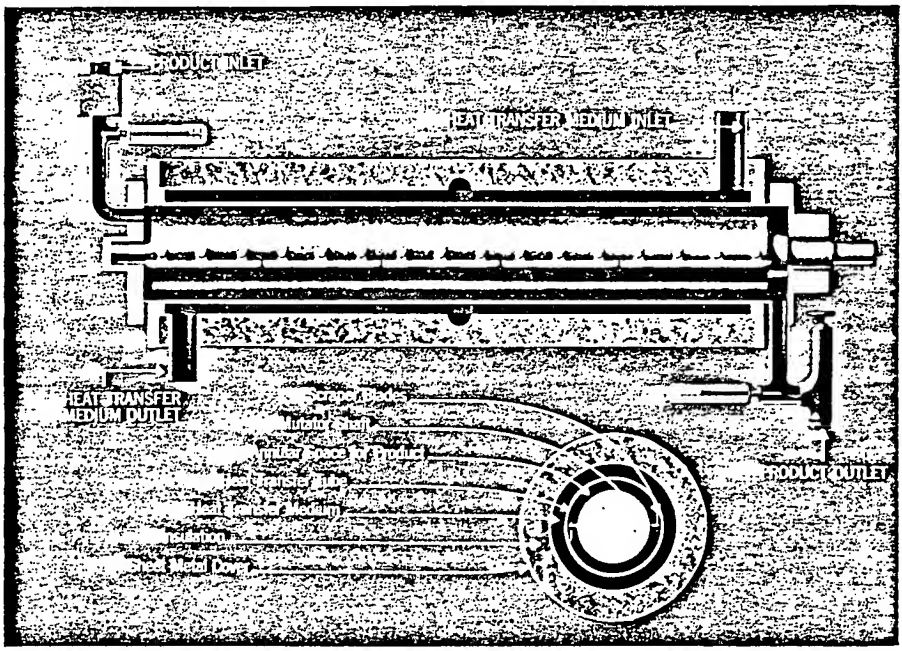
ALMOST invariably the processing of viscous materials involves heating or cooling. Votator equipment provides a continuous, closed system embodying the cleanest, safest, most efficient heat transfer operation for this purpose. Does a dependable, more uniform job in generally less than half the floor space required by batch methods. Makes possible corresponding savings in labor, heat or refrigeration, and overall operating expense for a great cross-section of industry.

The above were picked at random from more than a dozen tried and proved Votator applications. There is also a long list of potential Votator applications which may include your products—the processing of viscous materials covers such a wide range of industrial territory.

If you process anything in viscous form which requires heating, cooling or both heating and cooling, chances are Votator equipment can cut your costs, increase your profits.

Votator
A GIRDLER PRODUCT

6/6/5



VOTATOR Systems have this heat transfer mechanism

VOTATOR equipment is setting new records for efficiency in the processing of liquid and viscous products which require heating, cooling or both heating and cooling.

This exclusive, patented heat transfer mechanism is one of the reasons why.

It is the most effective application known of the basic theory that a clean heat transfer surface together with a high ratio of heat transfer surface to volume of material being treated, does the best heat transfer job.

The material is forced into a narrow, annular passage, there contacts the heat transfer surface as a thin film. Revolving scraper blades constantly expose a clean surface to the material.

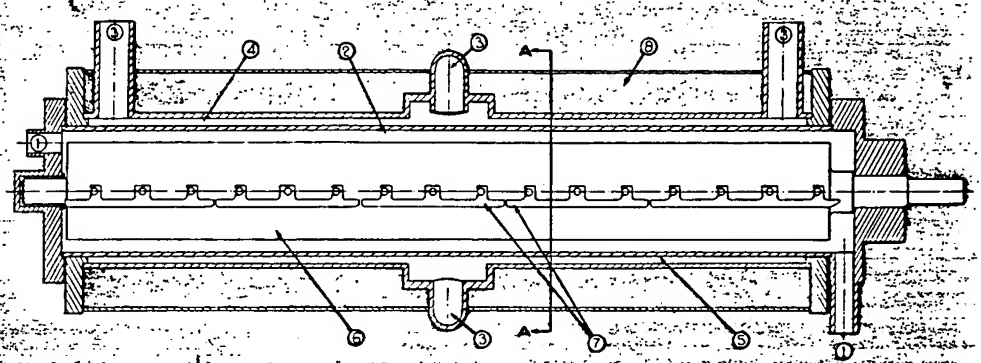
The material is heated or cooled, as the case may be, almost instantly. This takes place under pressure, non-stop, and a remarkable volume is handled in relation to the size of the equipment.

VOTATOR—T. M. Reg. U. S. Pat. Off.

THE GIRDLER CORPORATION, VOTATOR DIVISION, LOUISVILLE 1, KENTUCKY

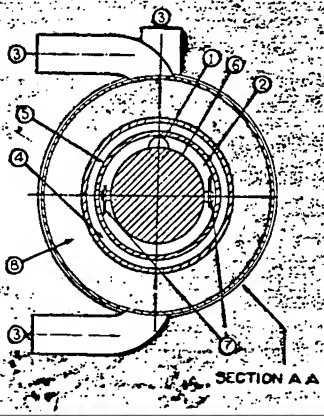
DISTRICT OFFICES: 150 Broadway, New York City 7 • 2612 Russ Bldg., San Francisco 4 • 617 Johnston Bldg., Charlotte 2, N. C.

DIAGRAMS OF VOTATOR MECHANISM



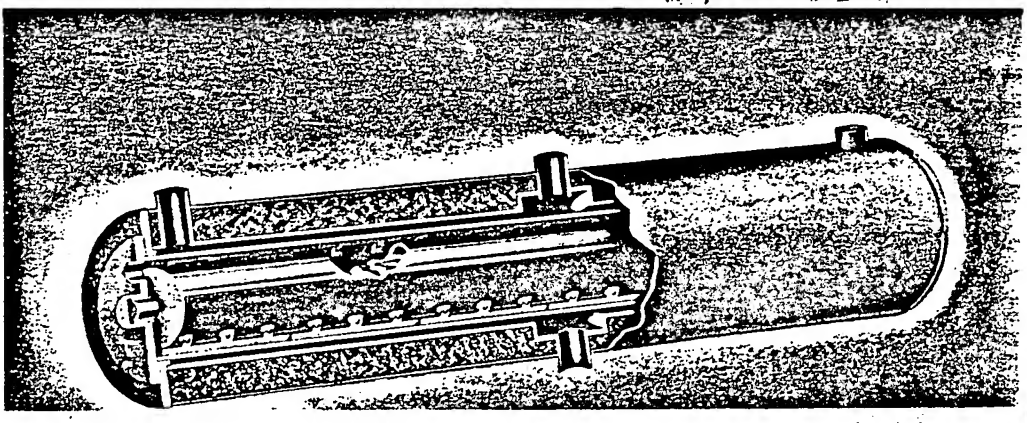
KEY:

1. Product Connections.
2. Annular space thru which product passes.
3. Heat Transfer Medium Connections.
4. Annular space thru which heat transfer medium passes.
5. Heat Transfer Tube.
6. Mutator Shaft.
7. Scraper Blades.
8. Insulation.



How the Votator Unit Operates

The material being processed is pumped in connection (1) thru annular space (2) and out connection (1) at opposite end, depending upon direction of flow desired. The heating or cooling medium enters at connection (3), passes thru annular space (4) and out connection (3), the actual piping arrangement to be determined by the type of heating or cooling medium used and the direction of flow required. The mutator shaft (6) carrying scraper blades (7) is motor driven, causing blades to scrape film from surface of heat transfer tube (5) several hundred times per minute.



(7) 1-15-47

Hydroxylation of acetylenic Hydrocarbons

C.A. 39, 814" (1945)

U.S. Patent 2,347,358 April 25, 1944

Nicholas A. Milas (to Research Corp.).

Unsaturated org. cpds. containing the acetylenic linkage $-C\equiv C-$ such as C_2H_2, monosubstituted acetylenes of the type $R-C\equiv C-H$ and disubstituted acetylenes of type $R-C\equiv C-R_1$ where R and R_1 are univalent organic radicals, are treated with H_2O_2 in an anhyd. inert organic solvent in the presence of a small amount of Os_2O_4, ReO_4, V_2O_5, MoO_2, or CrO_3 in the absence of an organic base. The resulting products are hydroxy aldehydes and (or) hydroxy acids.

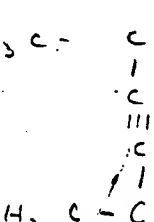
Note - C.A. 31 (1937) to C.A. 39 (1945) covered as to oxidation (by air or otherwise) of $-C\equiv C-$ with a mild reagent.

synthesis and degradation of acetylenic ... Styr...

C.A. 40, 3394⁸ (1946).

A. Babayan - Bull. armenian Branch acad. Sci. U.S.S.R. 1941 no 5/6 (10/11), 121-45 (in Russian)

B. dehydrated 2,5-Dimethyl-2,5-dihydroxy-hexine-3 with Me-C6H4-SO3H to yield (80%)



b.p. 123-124° C
d20 0.7863

was accomplished by slowly distilling the hexine from the sulfonic acid under vacuum.

A. BRO..HMAN & ASSOCIATES

No. 1 of

Date: 11-2-67

By: H.A.

JOB: Mettur

SUBJECT: $Ca(OCl)_2$ Production

Action of H_2O_2 on unsaturated HC

Berichte 33, p. 2015-18 (1900)

C.F. Cross, C.J. Bevan and Th. Heiberg
(Communicated with Fenton)

action on C_2H_2

1. add 0.125 gms. $FeSO_4 \cdot 7H_2O$ per 50 cc of diluted (3%) H_2O_2.
2. To this soln. add the C_2H_2 (a limit. not quan.) till the reaction is complete. Keep the temp. at 50°-70° C.
3. Data - per 50 cc H_2O_2.

Exp. No.	H_2O_2 %	Reaction products: $H_3C-COOH$	EtOH	$H_3C-C^{O}_{H}$
1	0.50	0.24	0.00009	0.0025
2	1.57	0.60	0.0014	0.0011
3	2.81	1.10	0.0015	0.0045
4	4.58	1.26	0.00119	0.0093
5	6.59	1.71	0.0016	0.0178
6	8.72	2.11	0.0010	0.0109
7	11.54	2.28	0.0004	0.0125

Note. - Fenton, J. chem Soc. 75, 1-11 (1899), uses for oxidation glycol 1 g 6.24 g glycol diluted in 7 cc H_2O

4. at room temp till and then let stand for 1½ hrs.
5. separate reaction product by forming ppt
of a ground.

Oxidation of $-C\equiv C-$ to acid

Org. Syntheses 21, p. 38-40.

N. Rabjohn, R. B. Whitehill, & A. V. McIntosh

Oxidize complex aromatic cpd. containing $-C\equiv C-$ side chain to the corresponding acid.

Data

1. Dissolve 0.1 mole of cpd in 300 cc AcOH
2. add a solution of dropwise { 37 gm. CrO_3 in 30 cc H_2O plus 400 cc. of AcOH
3. Keep temp at 50° C
4. addition should take 10 min.
5. Keep temp at 50° C for additional 10 min.
6. Cool solution. (T°?)
7. Destroy excess chromic acid by adding 30 cc of MeOH - Keep T° below 50° C.
8. Conc. reaction mass by distillation under reduced pressure
9. Distill rapidly at first; then carry out below 50° C; at 10 mm. the conc. requires about 2 hrs.

⑤ 11-19-46

Oxalic acid from acetylene

J. A. C. S. 45, 795-9 (1923)

M. L. Kearns, L. Heiler, & J. A. Nieuwland

Data

1. Three flasks are connected in series to a gasometer
2. In each flask is placed a mixture of
   - 90 cc conc. HNO_3 (Sp. Gr. 1.42)
   - 300 cc H_2O
   - 15 gms. $Hg(NO_3)_2$
3. acetylene and air (in 7:1 ratio) are passed into the first flask and then the other two flasks. The first flask is agitated.
4. When the reaction in the first flask has moderated, the first and second flasks are transposed and the process repeated till all three flasks have been exchanged
5. The three mixtures are then combined and C_2H_2 passed in till all evidence of reaction has ceased.
6. The oxalic acid separates in crystalline form. (It is washed with distilled H_2O & dried.) The yield is approx. 1000 gms.

11-18-46

Oxidation of dulcitol & d-glycols

C.A. 31, 5793[6] [J. Gen. Chem. (U.S.S.R.)]

Tetraphenyl hexitol diol is oxidized to

2, 2, 5, 5 - tetraphenyl - 3, 4 - dioxotetrahydrofuran

5 g. tetraphenyl cpd. dis in 25 cc $AcOH_{(glacial)}$

add 2.56 g. Cr_2O_3 dis in 25 cc of 95% AcOH dropwise + stirring.

Ext. furan cpd. with petroleum ether. — yield 51%

Reaction between O_2 and acetylene in the presence of Nitrogen oxides

J. A. C. S. 53, 2962-7 (1931)

S. Lichter

C_2H_2 is oxidized by O_2 thus:

1. Nitric acid vapor is introduced into a gas mixture of 1:1 C_2H_2 and O_2 by first passing the O_2 thru a wash bottle containing 90% HNO_3 and only 0.046% nitrogen peroxide.

2. Data (partial) { 190 cc of 1:1 C_2H_2 - O_2 mixt. contact time = 5 min.

Temp., °C	HNO_3 in mixt., %	Reaction Products: CO_2, cc	CO, cc	H_2 cc	Glycol, gms.
210	1.7	0.3	5.2	0.1	0.0132
230	1.7	1.1	4.2	0.2	0.0150
210	4.1	3.4	19.1	0.3	0.0362
230	4.1	6.2	20.1	0.3	0.0418

3. Principal reaction product is formic glycol, corresponding to 50-60% of the acetylene oxidized.

4-20-47

Bull. de la Société chimique 25, 346-369 (1911)
Marcel Delépine

Formation & Decomp. of Acetals

1. D. reacted methylal in sealed tubes under the following conditions: Time 3-6 hrs. HCl N/2

	lim.*		
1 H_2O	0.78	16 H_2O	0.245
2 H_2O	0.69	32 H_2O	0.195
4 H_2O	0.57	64 H_2O	0.061
8 H_2O	0.42	128 H_2O	0.044

* lim = fraction of methylal remaining

2. Says Hydrolysis takes place best with HCl < H_2SO_4, < AcOH.

3. Other results - cold ✓

1 methylal + 16 H_2O @ r.t. → < 1 part/1000 of methylal reacted in a month

~~methylal + 16 H_2O~~ @ 14-16°C $M_1 = \frac{M - L}{1 - L}$

HCl N		HCl N/2		H_2SO_4 N/2	
Time	M	T	M	T.	M
				17	0.92
5	0.77	17	0.78		
28	0.45	47	0.60	69	0.75
216	0.38	168	0.38	191	0.38

(2)

4.20.44

T	M	T	M	T	M
21	0.64	16	0.97	3	0.96
70	0.24	—	—	21	0.77
120	0.096	130	0.89	289	0.14

T	M
18	0.72
69	0.26
113	0.09

T	M
12	0.53
46	0.36
70	0.21

J. Phys. Chem. 36, 2325-2337

Decomposition of methylal in hot flask to among other gases.

E.T. Herring

methylal decomposed in the gas phase at 410°C in a quartz vessel, doubling its pressure in about 81 minutes & then changing slowly without reaching equilibrium even after 7 hrs.

acetal → pressure nearly 3 times original at 370°C indicating that the acetal molecule breaks up into two molecules.

4-20-47

Berichte 70, 1713 - 1719 (1937)

Hydrolysis of acetals

J. Loberung & A. Fleischmann

1. $K' = \frac{1}{(t_2 - t_1)\, 0.4343} \log \frac{a - x_0}{a - x_1}$

$\frac{k'}{\text{conc of acid catalyst}} = K_s$ (hydrolysis constant)

30°C

$k = 5.3 \times 10^{-3}$

$K_s = 3.01 \times 10^{-4}$

$t_2 - t_1$	cc HCl	% CH_2O	K
40	1.28	25.4	5.2×10^{-3}
245	4.06	74.5	5.45×10^{-3}
456	4.97	91.0	5.40×10^{-3}
710	5.46	100.0	—

2.

t °C	K_s
10	0.56×10^{-3}
14.17	0.74 "
20	1.22 "
25	1.88 "
30	3.01 "
35	8.58 "

V-1-47

Biochem. J. 67, 424-429 (1954)

Velocity of acetal hydrolysis

M. H. Palomaa & Aimi Salomaa

C_A = acetal normality

C_{H+} = H^+ normality

$k = \frac{1}{t_2 - t_1} \ln \frac{(V_1 - V_\infty)}{(V_2 - V_\infty)}$

V = titrating solution

t = 1 minute

For methylal

C_A = 0.3065

C_{H+} = 0.5507

k_{25} = 0.00197

k_{35} = 0.00860

$\frac{k_{35}}{k_{25}}$ = 4.56

also,

C_A = 0.3

C_{H+} = 0.15

k_{25} = 0.00153

C St #307

Ex 21

SAC, Philadelphia

7/10/50

SA T. SCOTT MILLER, JR.

HARRY GOLD, was.
ESPIONAGE - R

EXHIBIT 65-4307-1B-13 (10) (Exhibit 21)

On 6/22/50, GOLD was shown the above material, at which time he stated that the letter on the stationery of the ACHESON COLLOIDS CORPORATION was from his friend, MORRELL E. DOUGHERTY.

PRESTO SALES, the name which appears on the envelope, made acetylene, and the BROTHMAN firm purchased same from PRESTO.

The remainder of the material is concerned with work at the BROTHMAN firm.

TSM:HKF
65-4307

1. Vapor phase esterification ✓✓

2. Hydration of chlorsulfonic acid

3. Hydrating action of H_2SO_4 @ various temperatures

4. Decomposition temperature of chlorsulfonic acid

5. Heat of soln. work on dehydration of α-OH-Ketones

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

MEMORANDUM

Aug 27, 1946

U.S. 2,416,[illegible]

SUBJECT: Chemical E. Rehberg (To U.S.D.A.)

Azeotropic distillation of MeOH from azeotropic mixture with acrylic esters.

1. C runs HC b.p. 58-61°C → azeotrope with MeOH.
2. be aligned with HC with b.p. 50-51°C below b.p. of [illegible] 40°C b.p. [illegible] HC [illegible] with [illegible]

Ex. 1
924 EtOH
8169 Me acrylate
184 H2O
[illegible] in HC
a. reflux → 48°C [illegible]
b. Distill 45-50°C → MeOH + HC
c. [illegible] intermittent reflux & take off

Ex. 2
a. MeOH - Me acrylate azeotrope b.p. 62°C
b. add [illegible] HC [illegible] of azeotrope distill
table azeo with HC
MeOH 46-48°C
EtOH 50-52°C
[illegible] 56-58°C

Form 501-100-7M5

MEMORANDUM

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

To

Subject

Sub-Heading

Referring to Letter of Copy to

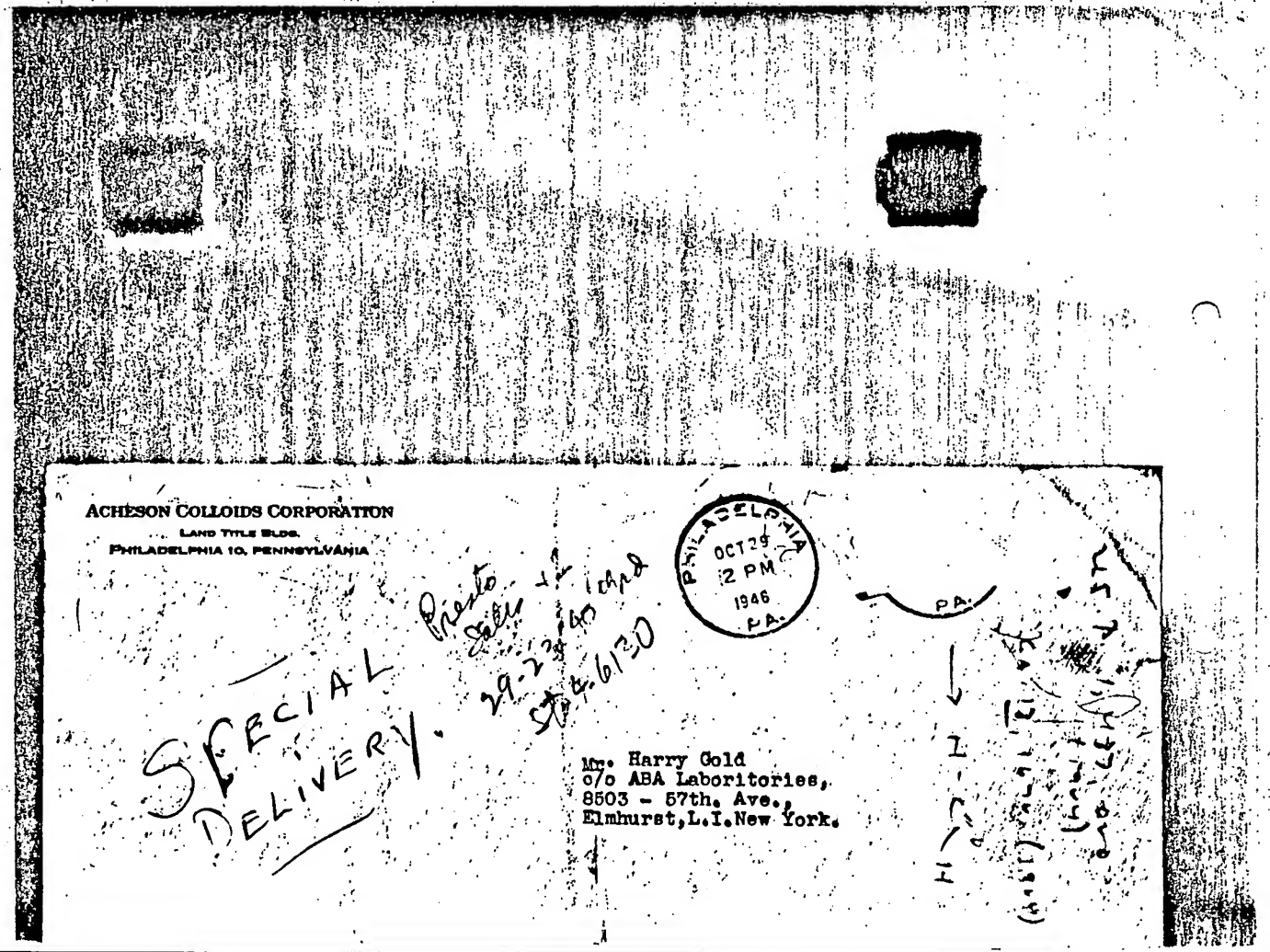
From

Date

Harry -

Wish you luck - see you over the week-end.

Doc



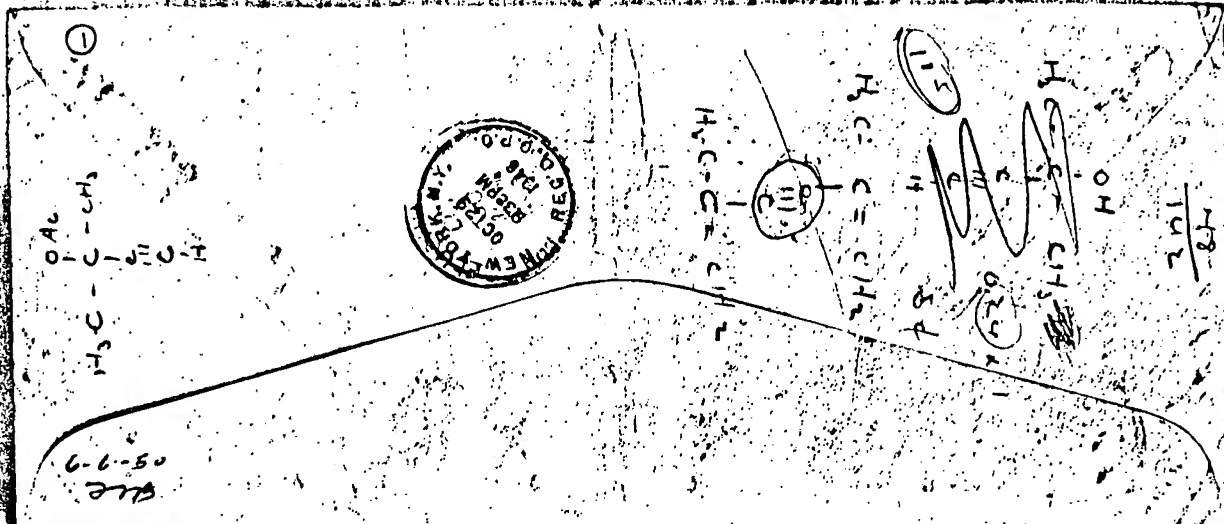
ACHESON COLLOIDS CORPORATION
LAND TITLE BLDG.
PHILADELPHIA 10, PENNSYLVANIA

PHILADELPHIA OCT 24 2 PM 1946 PA.

PA.

SPECIAL DELIVERY.

Mr. Harry Gold
c/o ABA Laboritories,
8503 - 57th. Ave.,
Elmhurst, L.I. New York.


6-6-50
NEW YORK, N.Y.

1 Vacuum take-off Still Head

---

1 Lab. Ozonizer "Harris Type" capable of delivering ~~[illegible]~~ a 5-8% Ozone Stream

1 ~~Drop~~ Jar 8½ x 11 with Desiccator Type Flange & equipped with a Head providing for

joint

a - agitation 24/40

b - a gas inlet tube 24/40

c - a Take-off Tube —

U-F Powder

1.9 mol CH_2O : 1 mol. urea

Take up in resin kettle to w.s. stage → 50% by [illegible]
wt Resin in [illegible]

Knead with Et cellulose to impregnate the Et cellulose
use a Σ blade mixer — 50:50 resin

Dry on trays. (→ chips)

Ball mill (→ 200 mesh)

Catalysts are added - amine salts NH_4Cl

Granulate (convert to granules)
(10 mesh)

3- also add lubricants - glycerol

R.C.

1. [illegible] to cellulose process
2. Et cell.
3. Ball mill
4. Granulation

Solubilities of p-Dichlorobenzene &

o-Dichlorobenzene in C_6H_6

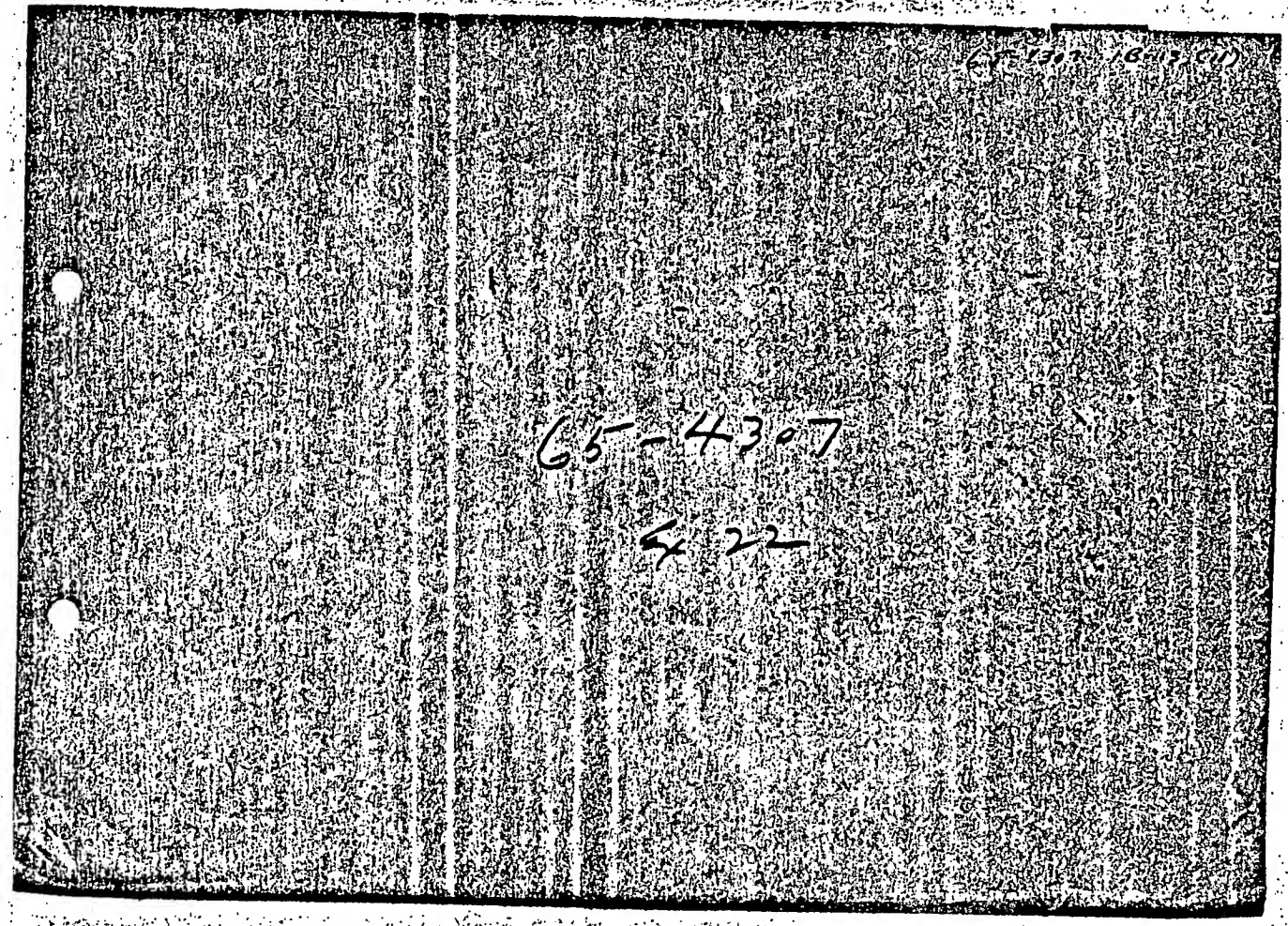
5° C

75 cm³ C_6H_6

100.0
− 32.7
4 | 67.3 cm³ p-Dichlorobenzene
− 11.8

100.0
− 26.8
73.2 cm³ p-Dichlorobenzene

20° C


65-4307
4-22

SAC, Philadelphia

7/10/50

SA T. SCOTT MILLER, JR.

HARRY GOLD, was.
ESPIONAGE - R

EXHIBIT 65-4307-1B-13 (11) (Exhibit 22)

On 6/25/50, GOLD identified the notebook pages comprising this exhibit as being his handwritten notes in connection with a chemistry course at the University of Pennsylvania, as well as a German course at the same institution.

It is noted that these notes are dated 1932.

TSM:HKF
65-4307

7/3/3 ✓

Localization of Industries

1. H_2SO_4 & fertilizer
   Large no. of small plants

2. (a) Petroleum Refining
   company leaders ∴ capital invested ∴ products of low bulk value ∴ refineries are near markets

   (b) Rubber. Raw material must be imported. British control market. Has high bulk value ∴ transport costs are not a controlling factor.
   Rubber is a laboratory product throughout. Produced in small batches. Do not have to ship tires any great distance to consumer.

3. (a) Salt Industry
   where raw material exists

   (b) Coal tar & chemicals
   located near greatest raw material & greatest demand for them exists.

4. Paper & Pulp. - Produces own products & does not depend on other products.

Factors
1. Raw material
2. [illegible]

3. tremendous quantity of high grade water.

1. ~~[illegible]~~ practically no production of pulp in Phila. ~~[illegible]~~ used to bring in wood, R but now bring in as paste in a drum or dry in sheets.

2. Use grain stalks for fairly high grade paper

5. Clay Products - little bulk value, economy of transport. In addition need fireplaces which require considerable fuel also skilled labor.

Glass industry - since things glass needs good sand

Fuel in Ph. C.
See Page 23 of text bol.

7. [illegible]

Capital ratio -

1. If [illegible] $ invested get $ sales capital ratio is one
If capital ratio is high
see p. 37 top
1. accounts receivable not due
2. stock of finished products is large
3. equipment obsolete
4. Inefficient utilization of floor space

6.50
200

next: specific industries
be able to tell what economic
factors control each industry

labor ?
raw material ?
market ?

6.6.50

Concludes 1st. Chap

Chap II

1 Statistical analysis of industries

Capital invest
Gas have large no. small plants. not economical to send gas long distances

Large invest for pumping to within 50 mi radius

natural Gas · only competition

petroleum refining

Wages Paid

rubber industry — largest skill'd labor
clay Products

2. Growth of Industry

3. Localization of Industries
see text p. 19

a market det. by density of population

b. must consider all variables in location of industry. market is greatest factor.

rubber industry near automobile industry

Wed 7/17/3✓
Dr. Lukens
Text p. 551-593

Iodometric Processes
&
Iodimetry

Reaction of iodine with starch is very much influenced by temp. Color vanishes on heating & reappears on cooling. Must be certain that solution is at room temp. or below.

I_2 may be produced by reaction or may be prepared as a std. solution

$I_2 + H_2SO_3 + H_2O \longrightarrow$

$2HI + H_2SO_4$

Production of blue more easily recognized than vanishing of blue.

Free chlorine can be estimated by I_2 method

$Cl_2 + KI \rightarrow KCl + I_2$

I_2 can be estimated as above.

Bunsen found that the upper limit of strength of H_2SO_3 was .04% that could be used. Bunsen extended method to Br_2, BrO_3^- ClO_3^-, chromates, chlorates, iodates, vanadates, manganates, ferrates etc.

substitute for H_2SO_3 proposed by Schwartz

$I_2 + 2Na_2S_2O_3 \rightarrow Na_2S_4O_6 + 2NaI$

not sodium hyposulfite

$Na_2SO_3 \cdot O$

replaced by S in

$Na_2S_2O_3$

reaction inapplicable. to neutral or faintly acid sol. but is not applicable to an alkaline solution even a bicarbonate.

$I_2 + H_3AsO_3 + 2H_2O \rightleftarrows$

$H_3AsO_4 + 2HI$

reversible because $[H^+]$ determines which way reaction goes

6.50 300

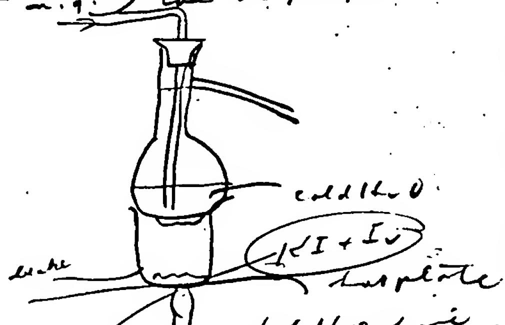
completing; of some difficulty in getting stopped point

best make certain that
sol.: iodide are present in sol in which titr. then in sample.

2 gms standard / liter.

prep. of std I_2 sol.

commercial I_2 contains Cl, Br, CN, etc. Can be purified (elaborate methods in [illegible]) Can be prepared



Then replace by hot H_2O [illegible]
crystals on top

to get rid of CN

and sublimation is quite sufficient.

I_2 Can be wt by diss. in H_2O + KI using a weighing bottle

6.6.50

If want reaction to go from left to right must have something to remove H^+

If want reaction to go from right to left must have excess $[H^+]$ & lead sol. to volatilize I_2

$$I_2 + NaHC_2H_3O_2 + H_2O \rightarrow NaH_2C_2H_3O_4 + 2NaI + 2HOI + H_2O$$

Prepare starch solution as we need it, mix starch in cold water & pour suspension into boiling H₂O until we have a clear-fluid starch solution.

Can keep starch sol. in small bottles practically filled to top & tightly stoppered or else use Hg trap.

may get violet or maroon color as one approaches end point. Can be avoided by completing most of the titration before the end point is reached & adding starch & then adding starch &

Formula weight KI sol. + then add I_2 crystals.

Use a N/10 I sol.

See test for meth.

Can also use As_2O_3 as std. Can be obtained pure & must be sublimed as a little Sb gives it a pronounced yellow color. > Sb red color.

$As_2O_3 + 2I_2 + 5H_2O \rightarrow$

$2H_3AsO_4 + 4HI$.

Weigh out As_2O_3 & dissolve in a $NaHCO_3$ sol.

Del end point on blue color with starch paste.

Amt KI in sol. of I_2. about twice weight of KI as was used I_2 in sol.

Wed. Feb. 24 Lec.

Dr. Lukens.

Prep. of $Na_2S_2O_3$ sol.

① Sharp end point

② Precautions

(a) $Na_2S_2O_3$ sol. not stable

as CO_2 dissolved in H_2O reacts with $Na_2S_2O_3$:

$Na_2S_2O_3 + 2H_2CO_3 \rightarrow$

$2NaHCO_3 + H_2S_2O_3$

$H_2S_2O_3 \rightarrow H_2SO_3 + \underline{S}$

H_2SO_3 reacts with Iodine ∴

$H_2SO_3 + I_2 + H_2O \rightarrow$

$2HI + H_2SO_4$

The sol. of $Na_2S_2O_3$ now appears to be stronger than before since

$2Na_2S_2O_3 + I_2 \rightarrow 2NaI$

$+ Na_2S_4O_6$

∴ sol. is stronger than originally made for H_2SO_3 also reacts with I_2.

CO_2 may be removed by boiling & will kill bacteria & if kept stoppered sol. will not change.

Light has no appreciable effect.

I_2 solutions also are not stable; method must have a convenient ~~[illegible]~~ for std. of I_2 sol.

An I_2 sol. is best made by direct weighing out as described in last lecture & should be used only for standardizing & not for analytical purposes.

Pure Cu wire is best test method for det. of $Na_2S_2O_3$

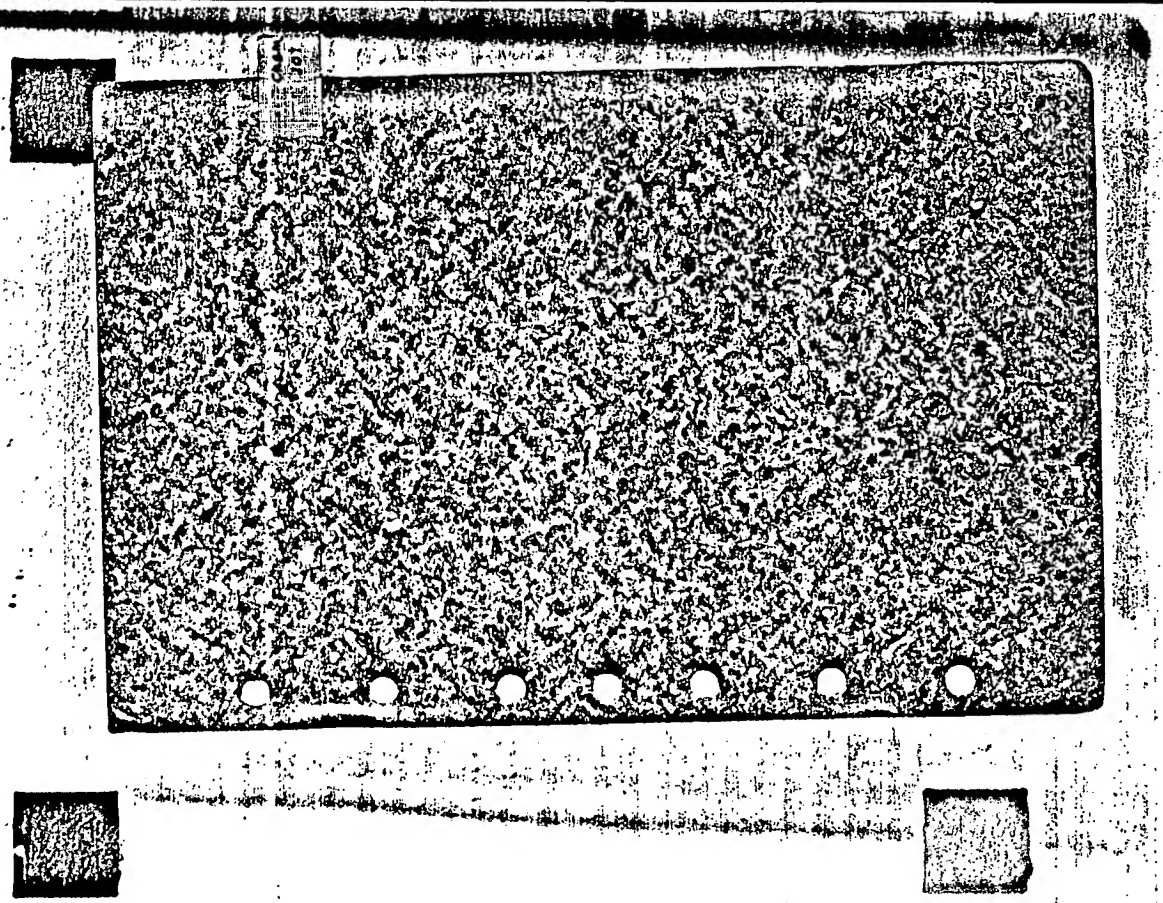
Weigh out carefully ~ g sample of pure Cu wire & dis. in HNO_3 ⇒ $Cu(NO_3)_2$. $Cu(NO_3)_2$

~~[illegible]~~

~~[illegible]~~ NH_3

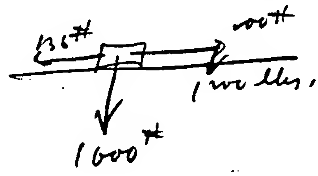
is then heated with ~~[illegible]~~ slight excess forming $[Cu(NH_3)_4](NO_3)_2$. To remove oxides of N as some they

6-6-50



$\bar{X} = r \sin\theta =$

$\bar{Y} = r \cos\theta - 1 = 0$



$f_R = 136$#

$a = ?$

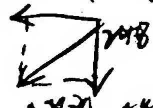
$200 - 136 = \frac{1000}{32} a$

$a = 1.28$ ft/sec²

$F = \frac{1200}{32} \times \frac{32}{28} + 200$ (218 written above)

$=$ 2218 lbs. force exerted on roadbed

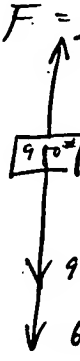
wt simultaneously on road bed = 1200#



[illegible] square & get resultant

3/4/3✓

(a) $F = ma$



↑ +
↓ −

$a = -4\ ft/sec^2$

$(T - 900 - 60) = \frac{900}{3\checkmark}(-4)$

$T = -114.5 + 960$

$T = 847.5$ lbs.

---

uniform velocity upward

$T - 900 - 60 = \frac{900}{3\checkmark} \times 0$

$T = 960$ lbs.

---

uniform velocity downward

$T - 900 + 60 = 840$

$W = 1600$

$m = 100$

$v_0 = 44 \text{ ft/sec}$

$t = 4 \text{ sec}$

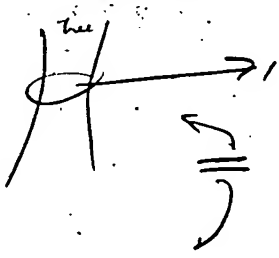
$v_t = 0$

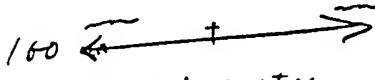
T

$a = +\frac{4}{4} = 11 \text{ ft/sec}^2$

$f = ma$

$T - 1760 = \frac{1760}{32}$





action takes place of tree

Newtons third Law - to every action there is an equal reaction in Vaj! forces occur in pairs -

get $\begin{cases} F = ma \\ VV = mg \end{cases}$

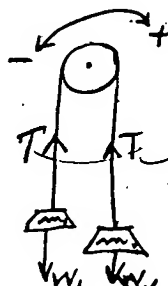
If mass in in lbs. weight will be in pounds

If mass in in slugs. weight will be in

05.2.9

~~method~~ rev. 1. 3/1/13 ✓

Cg. Grav. unit unit of force is the pull of the earth on a 1 gm. mass. (Gives a the 1 gm mass an acc. of to 980 cm/sec²)



$m_2 > m_1$, same as pulley in g. actualism

accelerations are equal

Cover up 1/2 of diagram & deal with 1 part

acceleration of gravity & pull must not be

f_R = ~~ma~~ a_R change

cause change of s. motion

$T - W_1 = m_1 a$

$W_2 - T = m_2 a$

3/4/3✓

① Na_2CO_3
Runs B

$R_i = 0.00$
$R_v = 34.39$
$R_c = 34.40$

H_2SO_4
Runs A
$R_i = 0.07$
$R_v = 34.45$
$R_c = 34.30$

② Na_2CO_3
Runs B
$R_i = 0.00$
$R_v = 33.14$
$R_c = 33.15$

H_2SO_4
Runs A
$R_i = 8.86$
$R_v = 41.90$
$R_c = 8.86$

3/11/3 J

① Na_2CO_3

$R_1 = 0.00$

$R_v = 32.83$

$R_L = 33.84$

H_2SO_4

$R_1 = 0.00$

$R_v = 33.28$

$R_L = 33.65$

②

$R_1 = 0.00$

$R_v = 31.40$

$R_L = 31.44$

$R_1 = 0.00$

$R_v = 31.31$

$R_L = 31.73$

6.6.50

2/25/32 w.g #1

R1

— 8,0002

R2

3.5486
2.6502
———
6.1988

R3

Pipet
Erlen + H2O = 251.99 g.
Erlen − H2O (100 ml.) = 152.00
———
99.99 g.
.32
———
22.09C 100.31 ml.

erlen dry = 92.56 g.
erlen + H2O = 192.39 g.
19.8°C = 4.29 ml.

3/11/32

19.2:39
9.2.56

99.83
+ .28
100.11

#1	H_2SO_4
R₂ = 33.07 cc. Na_2CO_3	R₁ = 1.67
R₁ = 0.00	R₂ = 33.25
Rc = ~~33.25~~ 33.08	Rc 31.55

#2	H_2SO_4
R₁ = 0.06	R₁ = 1.02
R₂ = 34.06	R₂ = 33.54
Rc = 34.01	Rc = 32.44

~~34.1~~

33.25
− 1.62
31.63
− .08
31.55

33.54
1.02
32.52
.08
32.44

6.6.50
om

[redacted]

[redacted]

Silica will be examined for
contaminating constituents.
It should be perfectly white
in color.

[redacted]

[redacted]

Aug 5.9.9

avoid hydrolysis.

H_2TiO_3 ~~as~~ might have some Fe & ! will be colored, Then have to resort to second fusion.

Filter out H_2TiO_3 ~~and~~ from boiling hot sol$_n$, wash with Δ H_2O, ~~ignite~~ ignite to TiO_2 & weigh

pure white

TiO_2 paint pigment which is fume resistant.

Reoxidize ferrous salt by HNO_3, & precip Fe by NH_3. Ignite Fe to Fe_2O_3 & filtrate precip Mg as $MgNH_4PO_4$ & ignite to $Mg_2P_2O_7$

H_2TiO_3 might cling to vessel ~~and~~ walls. Best to diss in Δ conc, H_2SO_4 & dilute & rehydrolyze again.

rid of Pt. Saturate sol. with H_2S ⟹ brown PtS_2 (still in cold).

H_2S + { $FeSO_4$ (hydrous sulfate SO_4^{--} / $FeSO_4^{=}$) ; $Ti(SO_4)_2$; $MgSO_4$ }

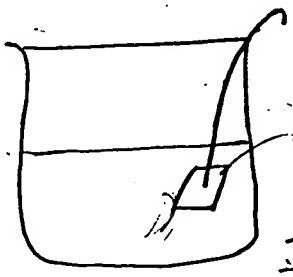
Dilute still further & heat to boiling (dil = 500-700 cc.) to dil. H_2SO_4

Prepare a strong sol of Na_2CO_3 & add it carefully dropwise to above. As drop hits sol. get FeS i.e. as the FeS dissolves & continue until a drop or two more would produce a permanent precip of FeS. In other words we reduced [H^+] to just enough to keep Fe in sol.

Heat sol to boiling while still passing H_2S thru sol. in erlen flask. i.e. H_2TiO_3 will separate as white ppt. Fe remains as $FeSO_4$ & Mg as $MgSO_4$.

purpose of keeping Fe in ferrous condition is to

quantity to ensure, & are able to lift it almost all out.



fuse over melt with conc H_2SO_4 & then bring in Pt wire etc.

Allow to dissolve in cold & dilute acid

$FeO \rightarrow Fe(SO_4)_3 + Fe_2SO_4$

$ZrO_2 \rightarrow Zr(SO_4)_2$

$SiO_2 \rightarrow SiO_2$

$MgO \rightarrow MgSO_4$

Finally filter out SiO_2 wash with H_2O & dil. H_2SO_4.

$KHSO_4$ acts on Pt ∴ ∴ to get

TiO_2 = Rutile

Procedure - .5 g ~~sample~~ of

$KHSO_4$ (comes highly hydrated)

$KHSO_4$ + water of crystal. $\xrightarrow{\Delta}$ fluid

+ bubbling + spattering $\xrightarrow{\Delta}$ quiet

drive off H_2O $\longrightarrow$ $K_2S_2O_7$

spattering [illegible] + H_2O $\xrightarrow[\text{[illegible] rutile}]{\Delta}$ $K_2SO_4 + SO_3$

• comes off regularly

does the work of converting constituents into sulfates.

First get to cool, then introduce weighed sample & heat just a little gentle & decomposition will be readily & efficiently accomplished. Keep crucible covered & watch it carefully.

Silica will float around in white flocks & any mineral of undecompos will be dark. Allow to cool

Pt wire let solidify to [illegible]

then apply burner flame

6.6.50 JJ

3/2/32 Wed.
Dr. Luken

Estimation of Titanium

p. 108, 115, 116, 124, 150, 156, 160, 549A, 597 J+H

where Ti would appear in a qualitative examination.

Ti not in first group - as chlorides sol.

Ti in third group. NH_3 lowers $[H^+]$ of solution & get hydrolysis & precip H_2TiO_3. ∴ get white gelatinous precip in sol. and which might be mistaken for Ti.

H_2TiO_3 might be mistaken for silica (in ores & minerals)

∴ to get Ti bearing ores into sol.

~~procedure with bisulphate fusion~~

use for example Menaccanite ~~manganite~~ ($FeTiO_3$)

$FeO + TiO_2$ Ilmenite

$Mn_{(s)} + NaI \rightarrow NaBr + I_{(s)}$

(1) Dissolve solute

$KIO_3 + 5KI + 6HCl \Rightarrow$

$6KCl + 3H_2O + 3I_{(s)}$

titrate with $Na_2S_2O_3$. This

3 moles I_2 for 1 mole KIO_3.

number of acids present may be liberated

$Cu SO_4 + 4KI \rightarrow$

$2K_2SO_4 + Cu_2I_2 + I_2$

Distill & liberated I_2 into KI or Cu_2I_2 gives color to starch.

6. Det. of Sb. by HI.

Sb often alloyed with Pb & sometimes Cu. Sb titrates Pb.

Sb in higher state of oxidation reduced by HI & I_2 is liberated & det. as usual

$H_3SbO_4 + 2HI \rightleftharpoons H_3SbO_3 + H_2O + I_2$

In presence of soluble tartrates preventing formation of basic salts in water reaction can be carried out without distillation. Have Sb as chloride in presence of tartrate & excess $NaHCO_3$.

Details see text.

7. H_3AsO_4 may also be reduced by HI.

8. MnO_2 (byproducts) det by liberating Cl_2 (from HCl) & conduct in KI sol'n Cl_2 will liberate into equivalency of Cl_2.

$MnO_2 + HCl \rightarrow MnCl_4$

$+ 2H_2O$

$MnO_4 + \Delta \rightarrow MnCl_2 + Cl_2$

$Cl_2 + 2KI \rightarrow 2KCl + I_2$

$HClO$ also.

9. Br_2 est. as Cl_2 in (8)

10. Evaluation of chlorates

$KClO_3 + 6HCl \rightarrow KCl +$
$3H_2O + 3Cl_2$

$3Cl_2 + 6KI \rightarrow 6KCl + 3I_2$

(11) $V_2O_5 + 2HBr \rightarrow V_2O_4$
$+ H_2O + Br_2$

6-6-50

[redacted]

cc. titrate with $Na_2S_2O_3$ adding starch toward end.

3 KI does not have to be accurately weighed out as long as we have excess.

Put in dark because light oxidizes HI

(which stood for a while)

Primary std. I_2 by As_2O_3 weighed out.

Applications of Std. I_2 Solutions used in oxidation reactions

(1) As alk with $NaHCO_3$

(2) $Na_2S_2O_3$

(3) Sb – sol. alk with $NaHCO_3$ should have tartarate to form complex with the Sb & prevent pptation of Sb.

(4) SO_2 may be determined only when $[H^+]$ is low otherwise dithionic acid may be the product instead of H_2SO_4.

$$2H_2SO_3 + I_2 \rightarrow H_2S_2O_6 + 2HI$$

∴ SO_2 sol. would appear to be weaker.

$2K_2CrO_4 + 6KI + 16HCl \rightarrow$
$10KCl + 2CrCl_3 + 8H_2O + 3I_2$

$K_2Cr_2O_7 + 6KI + 14HCl \rightarrow$
$8KCl + 2CrCl_3 + 7H_2O + 3I_2$

get chromic salt green or violet g. & f. quite difficult to recognize end point. Best to use ~~—~~ have both solutions extremely dilute. put slightly. MnO_4 ~~[illegible]~~ or AgCl in sol. of $K_2Cr_2O_7$ makes colorless (investigate?). changes from deep green to colorless.

4. Det of Fe

$2FeCl_3 + 2HI \rightleftarrows$
$2HCl + 2FeCl_2 + I_2$

easily reversible ∴ it is advisable to distill iodine from sol. into KI & then titrate I_2 with $Na_2S_2O_3$.

5. Cupric salts with iodides:
(see application)
conducted in presence of free HAc, HCl, & HNO_3, H_2SO_4
if I distilled & det in distillate — otherwise

6-6-50 [illegible]

Rec. 10/19/50 - mar

applications of Iodometric processes

two Types

① I (element) are dis in KI acts as an oxidizing agent & I_2 is titrated

~~(2) I~~

1. Process for extraction of free Bromine

Cause Br_2 to come in contact with excess KI

$Br_2 + 2KI \rightarrow 2KBr + I_2$

& det I_2 by (titr) $Na_2S_2O_3$.

many times other things with Br_2 [illegible] Br_2 water and [illegible] Br_2 is distilled off into KI bulb & titration is made directly in receiving vessel

2. Cl_2 (same as Br_2)

Carry out both of above reactions in acid solution.

3. Det of Co in presence of free acid while in higher state of oxidation.

would dis Cu which would use $Na_2S_2O_3$ ∴ boil sol. to remove NO_2 & add Br_2 water as acid & boil off Br_2 to make sure all NO has been driven off.

Neutral of excess of NH_3 & add HAc to diss any $Cu(OH)_2$ which may sep., & the sol. now contains $Cu(NH_3)_4(NO_3)_2$ & bring into contact with about 3 g KI. I_2 will be liberated. Run in $Na_2S_2O_3$ sol. until I_2 is almost but not entirely consumed. Then add starch paste & complete titration to colorless.

Since CuI remains in sol. a faint blue color due to adhesion of starch may remain after end point.

$$2Cu^{++} + 4I^- \rightarrow CuI_2 + I_2$$

$$I_2 + 2S_2O_3^{=} \rightarrow 2I^- + S_4O_6^{=}$$

A std. sol. of $KMnO_4$ sol. may be used instead of CuI_2

The $KMnO_4$ is added to an acid sol. of KI

~~$KMnO_4 + KI +$~~

$2MnO_4^- + 10I^- + 16H^+ \rightarrow$

$2Mn^{++} + 8H_2O + 5I_2$ immediately

std a vol of 25-40 cc. 0.1 N sol. of ($KMnO_4$) 50 cc. H_2O in a beaker
a run into a vol of 50 cc of H_2O containing 2 g KI & 5 cc of conc. HCl. The mixture should then be placed in the dark for 2-5 min & dil to 300 cc. & titrate with $Na_2S_2O_3$ to be standardized. [illegible]

also

$Cr_2O_7^{--} + 6I + 14H^+ \rightarrow$

$2Cr^{+++} + 3I_2 + 7H_2O$

a std. $K_2Cr_2O_7$ by direct weighing (accurately) out.
25-40 cc of $K_2Cr_2O_7$ run into beaker & add 2 KI + 50 cc. H_2O + 10 cc. free conc. HCl & allow to react in dark, dil to 200-400

Dilute to 100 cc. & titrate with standard $K_2Cr_2O_7$ to the appearance of a violet blue coloration remaining unchanged on further addition of oxidizing agent. So subtract from vol. of $K_2Cr_2O_7$ used the .05 cc. which is the amount of .1 N $K_2Cr_2O_7$ necessary to oxidize the indicator. Calc. % Fe from sample.

9.

p. 95 see

c - Bureau of mines
d - Dept of interior
e - Treasury Dept.
f - Geological Survey
g - Reports of

6-6-50

Estimation of Production Costs
& Profits

1. Rechert p. 61

a - people lost ~~money~~ when
a scientific study would
have shown how hopeless
proposition was
use more of methods

2. [illegible]

a - Book on research from
economic side
to get [illegible] & D [illegible] book.

points out
b - It is imp to sales dep to det. demand
or what yield can be expected
as basis for cost estimates
1. Have careful analysis of
costs of [illegible]
plant before starting
2. make budget.

3. Diff. bet lab [illegible] &
pilot plant
1. Costs higher in pilot plant

p 66 & 67
items for budget
Det. costs for all capacities besides
~~normal~~.

p 67 Example of process development

Market surveys
1. Study demand
a - Dept of Commerce bulletin
b - Bureau of [illegible]

3/10/37

Market Survey & Reproduction Financing

Financing New Untried methods

1. Sale of additional capital stock

In order to do it must have organization already set up

2. Long term loans or bonds.

Also needs long established company.

3. Short term loans - not so good as they may be called.

4. Financing from employees will to have already well organized organization

Heirs & Donors

Problems in Research

Research ordinarily classified as overhead & usually first to go in depression.

Laboratory is ordinarily a service bureau

1. Can estimate costs by keeping account of how many

depts & how much you have helped.
not always possible to do this
as a little testing of ten do a great service.
∴ record every analysis & show how much each analysis would cost outside

Development Dept.
and get last years costs & estimate this years & what they can hope for in way of a return. If have finished anything estimate its value & state.

summary: you may know value of your dept but management does not unless you put it down in black & white.

For Every Development Problem.
1. personnel [illegible] for completion
2. [illegible] of problem
3. no of
4. App & [illegible] usable
5. Value of Product

Items for overall Budget
1. Direct Salaries & Direct Labor
2. Lab. Equip
3. materials & supplies
4. Salaries for direction & supervision
5. Indirect Salaries & Labor
6. Light, Heat & Power
7. Telephone, Printing, Postage

6.6.50 [illegible]

8. Travel Expenses
9. Memberships dues
10. Bonus & special compensation
11. Insurance
12. Rent for Building & Tools
13. Gen'l Administration overhead.
14. Add'l Plant Expense
15. Miscellaneous Expense

fixed Expenses

Market all Increase

1. Any Improvements of Existing Process
   a. Reduce cost of operation
   b. Improve Quality of product.
2. Developed new uses for existing products.
3. Developed entirely new process
   a. old product
   b. Brand new product
4. Put out Patents
   a. Sell out to organization
   b. Sell patent outright
5. Supplies Ideas for Sales Organization
   1. "years of Research Idea"

Intangible things hard to analyze
1. Help customers & breeds Good will.

next Patents
[illegible]

6.6.50
[illegible]

not known or used by others in this country before his invention thereof, or not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, or more than two years prior to his application, unless the same is proved to have been abandoned, and upon payment of the fees required by law, and other due proceedings had, obtain a patent therefor.

a patent is a contract between two parties
1. Inventor - Gets monopoly
2. Public (Govt.) - Gives idea to public.

at the end of several years. right ceases & only by special act of Congress could be renewed

Obtain Patents on
1. arts
2. machines
3. Compounds or composition of matter
4. Designs

6.6.55

3/11/37

Wright - manufacturing & patented (library)

Rossman - clerical patents

1893 - patent # 500000
1911 - " 1,000,000
1934 - " 1,500,000

51 patents in U.S. give 1,000,000 a year

85% of industrial wealth is protected by patents

Why want a patent

1. Can keep it secret
   a. no labor turnover
   b. Integrity of workers
   c. Closed shop (keep people out)
   d. somebody else might get same idea
2. Can get patent
   1. Have to publish whole idea
   2. Their monopoly for years that patent runs

Sec 8, Art 1. patent & copyright

1. secure to public
2. to promote progress

Any who has invented or discovered any new & useful art, machine, manufacture or composition of matter, (chemicals)

or any new & useful improvement thereof,

9/14/38

Chap II

Developments of Ch. C. Projects

1. Research Laboratory

Want to know if
1. Basic ideas are sound
2. Is it attractive economically

1. Economics (a) must be available after have developed idea/process patent | should search all patent literature in [illegible] patent
(b) of sale potential market exists

(c) peculiar characteristics with respect to distribution.
a - Rayon
1. Conduct "consumer test"

(d) Financial Risk
1. ∴ must develop step by step.
2. must have ample capital available before starting
(a) concerns [illegible]
(b) concerns [illegible] by other concerns who developed fully
3. [illegible] a budget before each step.
4. ∴ have accounting department & estimate expense.

(e) Have experimental dept entirely separate from

cost of plant

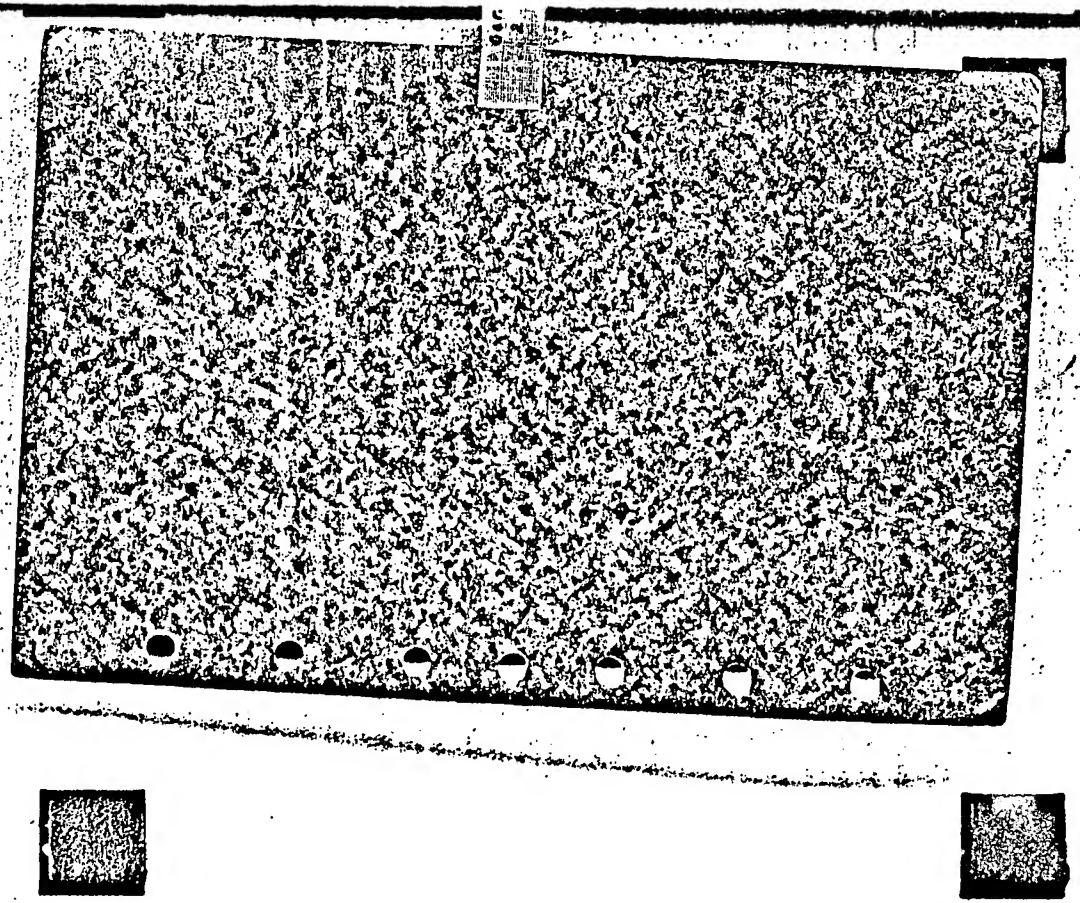
~~Principles of Tech~~
Principles of Tech. Developing

1. Research usually carried out first in routine laboratory but then it is carried out into plant by chem. engineers

2. Development
3. Full scale Final step.

method for Ch. E. Process developing (H. Littering) [illegible]
1. Beaker on laboratory scale
2. Larger lab operation
3. Large single unit
a - Design of apparatus
(1) not all essential to unit
b - Knowledge of Designs
(1) Soap . stirring device with studies first
need had to design and
(2) Require large organization for specialists in a - & b -
then
1. Draw conclusions on the materials of construction & design
of commercial plant
4. Semi - commercial plant
(all features - works)
1. ought not to seriously change important details
5. Pilot plant (commercial plant)

6.6.50



p. 30
anstreichen, i, i, to paint
die Wachtstube - n, guard-room
das Gildehaus - es ¨-er, guild hall
ungefähr, approximately
das Standbild - es - er, statue
vergoldet, gilded
das Zepter - s - scepter
die Weltkugel - n, globe
erraten, ie, a
der Dom - es - e, cathedral
der Kaiserstuhl - s ¨-e, imperial throne
niederreißen, ie, i, to tear down
bedeutungsschwer, portentous
abbrechen, a, o, to tear down
die Rumpelkammer - n, lumber-room
die merkwürdigkeit - en, curiosity
aufstellen, to place on view, exhibit
die Glasmalerei - en, stained glass
p. 31 das Gemälde - n, painting
ferner, furthermore
heidnisch, heathen
der Opferaltar - s - e, sacrificial altar
viereckig, four cornered
die Lade - n, desk, box
die Karyatide - n, caryatid
gedrückt, cramping, bending down
stützen, to support
unfreundlich, unpleasant
häßlich, ugly
das Gesicht - s - er, face
ein Kunststück schneiden, to grimace
indessen, however
der Christkopf - es ¨-e, head of Christ
der Dom - s - en, thorn
freilich, to be sure, indeed

p. 37 [illegible], [illegible]

das Hinsterben -s, death

gottgeboren, born of God.

der Heiland -s -e, Saviour.

das Leiden -s -, suffering

hineinschnitzeln, to carve into

eher, rather

der Lehrsaal -s -säle, lecture-room

der Gasthof -es ¨e, inn, hotel

der Wirt -s -e, host

überflüssig, superfluous

langweilig, tedious

erlösen, to save, rescue

who? what? where? by what means? why? how? when?

abgetragen, worn out

hervorgehen, to appear

erwerben, a, o, to acquire

p. 38 die Vaterstadt ¨e, native town

das Erbbegräbnis -ses -se, family vault

aufgeklärt, 'enlightened', rationalistic

gleichgültig, immaterial

schriftlich, in writing, in 'black and white'.

unheimlich, uncanny

schlau, sly, cunning

kümmerlich, thin

das Äuglein -s -, little eye

verblichen, dim

ängstlich, fearfully, timidly

ich will --- gesagt haben, I didn't mean to say

der Kirchhof -es ¨e, churchyard

ordentlich, regular

streichen, i, i, to stroke

6.6.50

p.36
ernsthaft, solemn, serious
der Bart -es ¨e, beard
bei den Chinesen gar, as for the Chinese
die Lust, joy, pleasure
die Ruhestätte -n, resting place
manierlich, refined
die Geige -n, violin
verzieren, to decorate
das Gitterwerk -s, lattice-work
das Porzellanfigürchen -s -, little porcelain figure

der Fetzen -s -, bit
bunt, varicolored
das Seidenzeug -es -e, silk stuff
künstlich, artificial
ansprechen, a, o, to appeal to
desto, the (with comparatives)
das Lockenköpfchen -s -, little head of curls

p.37
herausschauen, to look out
das Parterrefenster -s -, ground-floor window

das Glockenblümchen -s -, little flower

artig, pretty
die Mütze -n, cap
kümmern (sich) to care, bother
aufgesperrt, gaping
das Maul -s ¨er, mouth (animal)
versteinert, petrified
das Glotzauge -s -n, goggle eyes
qualifiziert, petty
der Diebstahl -s ¨e, larceny
hold, fair, lovely

p.33 zurückstürzen, to rush back
das Antlitz -es -e, countenance
genau, detailed
durchsichtig, clear
die Verkörperung -en, embodiment
der Sommerabendhauch -es -e, summer evening breath
der Nachtigallenlaut -es -e, song of nightingales
der Rosenduft -es ¨e, scent of roses
der Hausflur -es -e, corridor
rasch, quick
entfliehen, o, o, to escape
beschwichtigend, conciliatory
geheim, secret
der Widerdruck -es -e, answering pressure
unbewusst, unconscious
die Zauberformel -en, magic formula
p.34 Schnurrbärte of Liebenswürdigkeit, fascination of their moustaches
bezwingen, a, u, to compel
das Logis -, -, room, lodgings
gewähren, to give, afford,
jagen, to sweep along
das Ross -es -e, steed, charger
die Mähne -n, mane
das Wasseraufgiessen -s, watering
die übrigen, the rest of
der Schrank -es ¨e, chest, cupboard
mit Brettern zugenagelt, nailed up with boards
durchbrechen, to break through
riesig, gigantic
der Peterschlüssel -s -, St. Peter's key
die Unsterblichkeit, immortality
aufschliessen, to open
6.6.50

p. 34
der Spießbürger -s -, Philistine
die Nachtmütze -n, night cap
die Tonpfeife -n, clay pipe
das Maul -s ¨er, mouth (of animals)
lau, mild
behaglich, comfortable
das Lebensatemchen -s -, spark of life
hineinvegetieren, to vegetate into
p. 35 der Geograph -en -en, geographer
verlegen, to change the position of
sehnsüchtig, yearning, longing
duften, to be fragrant
das Menschenherz -ens -en, human heart
unbelauscht, unobserved
stärker fühlt, feels more intensely
wonnig-verschämt, with charming shyness
umhüllen, to envelop
aushauchen, to breathe forth
erzeigen, to show
die Seligkeit -en, bliss
beben, to tremble, quiver
die Augenwimper -n, eyelashes
aufschlagen, to open
schimmern, to gleam, glitter
smaragden, emerald
schnüren, to pack
der Ranzen -s -, knapsack
p. 36 zubringen, zubrachte, zugebracht, to spend
seltsam, strange
begegnen, to happen to
die Angst ¨e, fear, terror
der Geist -es -er, ghost
der Österreichische Beobachter, the Austrian observer
der Verstand -es, reason
das Gemüt -s -er, soul
zufällig, accidental
behaupten, to maintain, assert
der Vernunftschluss -es ¨e, process of reasoning

P. 32
die Vernunft, reason
fortwährend, continually
der Vorzug - es ¨ e, excellence, advantage
pflegen, to be accustomed
abstrakt, abstract
transzendentalgrau, gray beyond belief
der Leibrock - s ¨ e, coat
eckig, harsh, angular
gerade (gerade), straight
streben, to strive
positiv, positive
herrlich, fine, splendid
[P3] das Christentum - s, Christianity
die Broschüre - n, pamphlet
die Unvernünftigkeit, irrationality
die Unhaltbarkeit, untenability
überhaupt, in fact
die Menge - n, quantity
die Vortrefflichkeit - en, excellence
renommieren, to boast
ernsthaft, serious, solemn
die Hinsicht - en, regard, respect
die Achtung, esteem
verdienen, to deserve
bestehen, to consist
der Hauptspaß - es ¨ e, best part of the joke

eben, just
einst, once upon a time
der Bediente - n - n, servant
anziehen, to move
beschwichtigend, conciliatory
indessen, however
entsetzlich, horrible
die Darstellung - en, portrayal
das Grauen, horror
durchfrösteln, to send a cold shiver through

6.6.?

p.3] auch, besides
erregen, to cause, produce
schauerlich, gruesome
p.39 zumal, especially
gräßlich, terrible
zutragen (sich), to happen
der Fleck – s – e, spot
unwillkürlich, involuntarily
überdies, besides, moreover
zweideutig, dim
unberufen, unbidden
aufrichten (sich), to sit up
erblicken, to perceive
unheimlich, uncanny
schwerfällig, ponderous
gähnen, to yawn
und zwar, and that too
völlig, fully
unterdessen, meanwhile
verfliessen, to elapse
von vorn, from the beginning
keifend, scoldingly
gell, gellend, shrill
ärgerlich, vexed
die Gevatterin – nen, gossip
schlottern, to shuffle
schlappen, to drag, toddle
rieseln, to run
das Mark – s, marrow
das Espenlaub – es, aspen leaf
wagen, to dare
das Gespenst – es – er, ghost
p.37 zusammenkneifen, to pinch together
der Augenkreis – es – e, orbit (of the eye)
spanisches Röhrchen, bamboo cane
stützen, to support

p. 39
mundfaul, slow, drawling
die Täuschung -en, illusion
die Phantasie -en, imagination
die Bedingung -en, condition
der Abschnitt -s -e, section
das Hauptstück -es -e, chapter
alsdann, then, thereupon
der Gespensterglaube -ns, belief in ghosts
problematisch, hypothetical
der Syllogismus —, -en, syllogism
der Beweis -es -e, proof
durchaus keine, no ... at all
klappern, to chatter
die Kartätsche -n, cartouche
die Seelenangst ¨e, mortal terror
unbedingt, unconditional
der Satz -es ¨e, proposition
spukend, ghostly
die Absurdität -en, absurdity
das Geratewohl, random
die Absicht -en, purpose
p. 40 der Hügel -s -, hill
der Nebel -s -, fog, mist
verscheuchen, to dispel
schauern, to rustle
der Nachtmantel -s ¨, night robe
die Tanne -n, fir
rütteln, to shake
der Schlaf -es, sleep
das Glied -es -er (pl.) figure
frisieren, to dress (the hair), curl
die Aktenmappe -n, mother
das Wiesental -es ¨er, meadow-vale
glitzern, to sparkle

p. 13

trotz, in spite of
ungeheuer, enormous
Kante, f., edge
vermuten, to suppose
( ) Anzahl, f., number
verhindern, to prevent
Verfinsterung, f., eclipse
① Nebelwangen, oscillations
bedeutend, considerable
( )

XI

Kreisel, m., top
① als bewiesen annehmen, accept as demonstrated

p. 14

① lässt - sich auffinden, consider not be discovered

regungslos, motionless
Gegenstand, m., object
verursachen, to cause
wuchtvoll, to fly quit
genau, exactly
entgegengesetzten, opposite
⑧ als die ist, from that
wieder, however
Schluss, m., conclusion
anwendbar, applicable

p. 15

XII

Schwere, f., gravity
Gewicht, n., weight
(Anziehungskraft, f., force of attraction
Folge, f., result
Schwerkraft, f., force of gravity
beschreiben, to describe
Gegenstand, m., the other hand
verwirren, to confuse

p.15 Bezeichnung, f., designation

(1) eng --- verbunden, closely connected

Vorstellung, f., conception

Seil, n., rope

bewirken, to produce

ziehen, to attract

(2) bei --- Körpern, with the mutually attracting bodies

unsichtbar, invisible

vorhanden, present

(3) Ferner --- gesprochen, moreover, (one) is spoken of as a force

fortwährend, continuous

p.16 fortstossen, to push

Ringkämpfer, m., boxer

(4) dadurch - dass - wirft, by his throwing down

(5) sich [illegible] --- handelt, refers to

stützen, to support

(6) nach - zu, towards

(7) wird - angerichtet, is occasioned

(8) welche --- von, which existed independently of

Naturgegenstand, m., natural object

zugänglich, accessible

tatsächlich, actually

Naturwissenschaft, f., natural science

Hauptpunkt, m., chief point

verschaffen, to secure

Naturgesetz, n., natural law

wonach, according to which

(10) irgend welche zwei, any two whatever

gegenseitig, mutual

allmählich, gradual

6-6-50 [illegible]

~~[illegible] 1/12/38~~

~~Gore - German Introd. Reader~~
~~Edition 1921~~

Ger. 3

p. 23 & 24

6 th exercise

1st 23 sentences

p. 25
Idioms & phrases for
review

write

/ Porterfield - German
Short Stories

~~Ger. p. 30 l. 6~~
~~p. 33 l. 12~~

~~[illegible]~~
~~1/29/38 [illegible]~~

~~[illegible]~~
~~[illegible]~~
~~[illegible]~~

$$I = \int y^{-} e^{(-+1)y} dy$$

(4) $\int (\sin ax)^{m} (\cos bx)^{n} dx$

$u =$ $\quad dv =$

$du =$ $\quad v =$

$= \int \frac{(\sin ax)^{m} (\cos bx)^{n-1}}{u} \underbrace{\cos bx \, dx}_{dv}$

(5) $\int \sqrt{a^2 - x^2} \, dx$

ans. for rest ex.

Chapter III

art 137
139
140

p. no 1 (a), (c), (b), (h)

(i) (a), (c), (f), (i)

ص ٧ ١٧ ⑤, ⑩, ⑯,

ص ٣٥, ③, a ٧ b

---

⑤ $\int \sqrt{a^2 - x^2}\, dx$

$\begin{cases} u = \sqrt{a^2 - x^2} & dv = dx \\ du = \dfrac{-x\, dx}{\sqrt{a^2 - x^2}} & v = x \end{cases}$

$= x\sqrt{a^2 - x^2} - \int \dfrac{-x^2 + a^2 - a^2}{\sqrt{a^2 - x^2}}\, dx$

$I = -x\sqrt{a^2 - x^2} - \underbrace{\int \sqrt{a^2 - x^2}\, dx}_{I} + a^2 \int \dfrac{dx}{\sqrt{a^2 - x^2}}$

$2I = -x\sqrt{a^2 - x^2} + a^2 \arcsin \frac{x}{a}$

$I = \frac{x}{2}\sqrt{a^2 - x^2} + \frac{a^2}{2} \arcsin \frac{x}{a}$

6.6.50 ٥٢٥

[redacted]

[redacted]

art 1v6 review 0-71.
" 1v7
" 1v8

- review formulas on p. 191, 194 for 13 min.
- art 1v9 practice diff - p. 195
  - (10) ?
  - (11) ✓
  - (15) ✓
  - p. 196
  - (18) ?
  - (20) ✓
  - (27) ✓
  - (28) ✓
  - (29) ✓
  - (33) ✓

Integration we mean to find a function when the derivative is given

when

$$\frac{dy}{dx} = f(x) \quad (1)$$

To find y

when

$$\frac{dy}{dx} = \frac{e^x}{x}$$

convert find y by elementary fn.

$$y = \int f(x)\, dx \quad (2)$$

$$dy = f(x)\, dx \quad (3)$$

(1), (2), & (3) are all identical

$$y = \int x^x\, dx$$

$$\frac{dy}{dx} = x^x$$

$$dy = x^x\, dx$$

$$y = x^x + c$$

05.9.9

suppose $F_1(x) = \int f(x)\,dx$

$F_2(x) = \int f(x)\,dx$

- show $F_1(x) - F_2(x) = C$

- $\frac{dF_1}{dx} = f(x)$ | $\frac{dF_1(x)}{dx} - \frac{dF_2(x)}{dx} = 0$

- $\frac{dF_2}{dx} = f(x)$ | $\frac{d(F_1 - F_2)}{dx} = 0$

- ∴ this is only possible when.

  $F_1 - F_2 \equiv 0$ Q.E.D.

- $\int$ ~ indefinite integral to show that there are any number of solutions

- $\frac{d}{dx}\left(\int f(x)\,dx\right) = f(x)$

- the derivative of an integral is $f(x)$ itself.

- $d\left(\int f(x)\,dx\right) = f(x)\,dx$

  $\int\left(\frac{dF(x)}{dx}\right)dx = F(x) + C$

Table of Elementary Integrals
(memorize)

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} + C \qquad (n \neq -1)$$

$$\int x^{-1}\,dx = \int \frac{dx}{x} = \log x + C$$

$$= \log x + \log C = \log Cx$$

$$\int \sin x\,dx = -\cos x + C$$

$$\int \cos x\,dx = \sin x + C$$

$$\int \sec^2 x\,dx = \tan x + C$$

$$\int \csc^2 x\,dx = -\cot x + C$$

$$\int \sec x \tan x\,dx = \sec x + C$$

$$\int \csc x \cot x\,dx = -\csc x + C$$

$$\int dx = x + C$$

6.6.50

$$\int \frac{dx}{x^2} = -\frac{1}{x} + C$$

$$\int \cos ax\,dx = \frac{\sin ax}{a} + C$$

$$\int \frac{dx}{\sqrt{x}} = 2\sqrt{x} + C$$

$$\int a^x dx = \frac{a^x}{\log a} + C$$

$$\int \frac{dx}{\sqrt{1-x^2}} = \arcsin x + C$$
$$= -\arccos x + C$$

$$\int \frac{dx}{1+x^2} = \arctan x + C$$
$$= -\operatorname{arc\,cot} x + C$$

Rules for elem. integration

(1) $\int A \cdot f(x)\,dx = A \int f(x)\,dx$

(2) $\int (f_1(x) \pm f_2(x))\,dx =$
$\int f_1(x)\,dx \pm \int f_2(x)\,dx + C$

Illustrative Example

$$\int \left(5x^3 - \frac{v^{y_3}}{3(x^{11})} + \frac{1}{5}\sqrt[7]{x^v} - \frac{1}{v} + 3\sin 5x + 7e^{-\frac{v}{3}x} + \frac{1}{vx}\right) dx$$

$$= 5\,\frac{x^8}{8} - \frac{v}{3}\,\frac{v^{-10}}{-10} + \frac{1}{5}\,\frac{x^{\frac{9}{7}}}{\frac{9}{7}}$$

$$- \frac{1}{v}x - \frac{3\cos 5x}{5} + \frac{7e^{-\frac{v}{3}x}}{-\frac{v}{3}}$$

$$+ \frac{1}{v}\log x + c$$

Que
05.7.9

Wed 2/12/82
14-23 hw.
p. 192-193.

~~$\int a^x dx$~~

$$\int \sin ax\,dx = \frac{-\cos ax}{a} + C$$

Table of Integrals

$$\int \frac{dx}{a^2+x^2}$$

If a were 1 we would have

$$\int \frac{dx}{a^2+x^2} = \arctan x$$

$\therefore$

$$= \frac{1}{a^2}\int \frac{dx}{1+\left(\frac{x}{a}\right)^2} = \frac{a}{a^2}\int \frac{\frac{dx}{a}}{1+\left(\frac{x}{a}\right)^2}$$

$$= \frac{1}{a}\int \frac{d\left(\frac{x}{a}\right)}{1+\left(\frac{x}{a}\right)^2} \quad \therefore$$

$$\therefore \int \frac{dx}{a^2+x^2} = \frac{1}{a}\arctan\frac{x}{a} + C$$

$$\int \frac{dx}{\sqrt{a^2-x^2}} = \frac{1}{a}\int \frac{dx}{\sqrt{1-\frac{x^2}{a^2}}}$$

(Now $\sqrt{a^2-x^2} = \sqrt{a^2\left(1-\frac{x^2}{a^2}\right)}$)

$$= \frac{a}{a}\int \frac{dx}{\sqrt{1-\left(\frac{x}{a}\right)^2}}$$

$$\int \frac{d\left(\frac{x}{a}\right)}{\sqrt{1-\left(\frac{x}{a}\right)^2}} = \arcsin\frac{x}{a} + C$$

Derivation of formula 19 p. 19

$$\int \frac{dx}{x^2-a^2}$$

Suppose

$$\int \frac{dx}{x+a} = \int \frac{d(x+a)}{x+a}$$ (writing continues)

$$= \log(x+a) + C$$

6.6.60

$$\therefore \int \frac{dx}{x^2-a^2} = \frac{1}{2a} \int \frac{2a}{(x-a)(x+a)}$$

$$= \frac{1}{2a} \int \frac{(x+a)-(x-a)}{(x-a)(x+a)} dx$$

$$= \frac{1}{2a} \left[\int \frac{x+a}{(x-a)(x+a)} dx - \right.$$

$$\left. - \int \frac{x-a}{(x-a)(x+a)} dx \right]$$

$$\int \frac{dx}{x^2-a^2} = \frac{1}{2a} \log \frac{x-a}{x+a} + c$$

Illustrative Example

$$\int \frac{dx}{3-x^2} = -\int \frac{dx}{x^2-3}$$

$$= -\frac{1}{2\sqrt{3}} \log \frac{x-\sqrt{3}}{x+\sqrt{3}}$$

$-\log a = \log \frac{1}{a}$

$\therefore \frac{1}{2\sqrt{3}} \log \frac{x+\sqrt{3}}{x-\sqrt{3}}$

ans for this
method formulas
p 196 - 197 practice all
your own

$$\int (5x^3 - 7)^{100} x^2 \, dx$$

$u = 5x^3 - 7$

$du = 15x^2 \, dx$

$$= \frac{1}{15} \int (5x^3 - 7)^{100} (15x^2 \, dx)$$

$$= \frac{1}{15} \int u^{100} \, du$$

$$= \frac{1}{15} \cdot \frac{u^{101}}{101} + C$$

$= \frac{1}{5} \frac{(5x^3-7)^{1.03}}{1.03} + C$

$\int \frac{\cos\theta \, d\theta}{\sqrt[3]{\sin^2\theta}}$

$u = \sin\theta \quad du = \cos\theta \, d\theta$

$= \int (\sin\theta)^{-\frac{2}{3}} \, d(\sin\theta)$

$= \frac{\sin^{\frac{1}{3}}\theta}{\frac{1}{3}} + C$

p. 198 all problems

(74) $u = \log x$

$\int \frac{u^2 \, du}{x} = \frac{1}{6} u^3$

$= \frac{(\log x)^3}{6}$

(7) $u = e^x + v$

$\int \frac{(e^x + v)^3}{3}$

Art used
Art 131
" 134
practise all integration
upon these
195, 196, 197
all 199
p. v. 01, v. 02
table of standard integrals
$\int \tan x \, dx = -\log \cos x + C$
$= \log \sec x + C$

6.6.45

$\int \tan x \, dx = \int \frac{\tan x \sec x \, dx}{\sec x}$

$= \log \sec x + C$

double cot by mult. by $-\csc x$

$\int \sec x \, dx = \int \frac{\sec x (\sec x + \tan x) dx}{\sec x + \tan x}$

$\sec x + \tan x$ is differential of

$\log (\sec x + \tan x$

(11) p. 103

$\int \frac{dx}{1 - \cos x} = \int \frac{(1 + \cos x) dx}{(1 - \cos x)(1 + \cos x)}$

$\sin^2 x$

$= \int \frac{1}{\sin^2 x} - \int \frac{\cos x}{\sin^2 x} dx$

$\sin x = u$

$\cos x \, dx = du$

$$= \frac{1}{2}\int \cos^2 2x\, dx + \frac{1}{2}\int \frac{\cos 2x \cdot 2x\, dx}{\sin 2x}$$

$$u =$$

$$= -\frac{1}{2}\cot 2x - \frac{1}{2\sin 2x}$$

$$= -\frac{1}{2}\cot 2x - \frac{1}{2}\csc 2x$$

$$\eta = \text{antilan}\frac{u}{a}$$

$$d\eta = \frac{a}{a^2+u^2}\,du$$

$$\int \frac{du}{a^2+u^2} = \frac{1}{a}\,\text{antan}\frac{u}{a}$$

$$\int \frac{du}{\sqrt{a^2-u^2}} = \text{arc sin}\frac{u}{a}$$

$$\int \frac{du}{u^2-a^2} = \int \frac{du}{u^2-a^2}$$

$$\frac{1}{u^2-a^2} = \frac{A}{u+a} + \frac{B}{u-a}$$

a used to find numerator

$1 = A(x-a) + B(x+a)$

If $x = a$

$1 = 2aB \qquad B = \frac{1}{2a}$

If $x = -a$

$1 = -2aA$

$A = -\frac{1}{2a}$

$\int \frac{1}{x^2-a^2}\,dx$

$-\frac{1}{2a}\int \frac{dx}{x+a} + \frac{1}{2a}\int \frac{dx}{x-a}$

$= -\frac{1}{2a}\log(x+a) + \frac{1}{2a}\log(x-a)$

$= \frac{1}{2a}\left[\log(x-a) - \log(x+a)\right]$

$= \frac{1}{2a}\log\left(\frac{x-a}{x+a}\right)$

$\int \tan x \sec^2 x\,dx = \int x^{n-1}\cdot x - \int dx$

$$\int \frac{du}{\sqrt{u^2 + a^2}} \qquad u = a \tan\theta$$

$$du = a \sec^2\theta \, d\theta$$

Can integrate $\int \frac{\sin x}{x} dx$

$$\int \frac{a \sec^2\theta \, d\theta}{\sqrt{a^2 \tan^2\theta + a^2}}$$

$$a^2 \sec^2$$

$$= \int \frac{a \sec^2\theta \, d\theta}{a \sec\theta} =$$

$$\log(\sec\theta + \tan\theta)$$

$$u = a \tan\theta$$

$$du = a \sec^2\theta$$

$$\int \frac{du}{\sqrt{u^2+a^2}} = \log\left(\frac{\sqrt{u^2+a^2}+u}{a}\right)$$

- Known Proof

Do not change sign under radical

- In case $= \sqrt{-1}$

- $\int \frac{du}{u^2-a^2}$

- $u = a \sec\theta$

- $du = a \sec\theta \tan\theta \, d\theta$

- $= \int \frac{a \sec\theta \tan\theta \, d\theta}{a \tan\theta}$

- $= \int \sec\theta \, d\theta = \log(\sec\theta + \tan\theta)$

- $\sqrt{a^2 \sec^2\theta}$

- $\sqrt{a^2 \tan^2\theta}$

$$= \log\left(\frac{u}{a} + \frac{\sqrt{u^2-a^2}}{a}\right)$$

$= \log\left(x + \sqrt{x^2 - a^2}\right)$

① $p = 0.5$

$$\int \frac{dx}{\sqrt{x^2+1}}$$

$$= \frac{1}{\sqrt{2}} \int \frac{\sqrt{2}\,dy}{\sqrt{y^2+1}} \qquad x = \sqrt{2}y$$

$p = 0.5$
even probs $= 11$

$p = 0.7$
odd probs to 17

6.6.50

2/26/32

$$\int \frac{2x\,dx}{\sqrt{x^2-1}}$$

let $x^2-1 = u$

$du = 2x\,dx$

$$= \int u^{-1/2}\,du$$

$$\frac{(x^2-1)^{1/2}}{1/2} = 2(x^2-1)^{1/2}$$

~~[illegible]~~ next 1 point

~~$2(x^2-1)^{1/2}$~~ $+ \log\left(x+\sqrt{x^2-1}\right)$

mmon
work to 18 p. 209 & 210

Study ~~[illegible]~~ page 153
& work a little
on p. 211

Interpretation by Parties
all over India

3/11/24

$$\int \arctan x\,dx = x\arctan x - \frac{1}{2}\left(\frac{x^2}{1+x^2}\right)$$

$u = \arctan x$

$dv = dx$

$du = \frac{dx}{1+x^2}$

$$= x\arctan x - \frac{1}{2}\log(1+x^2) + C$$

$$\int x^3 \arctan x\,dx = \int \arctan x\,(x^3\,dx)$$

$u = \arctan x$

$du = \frac{dx}{1+x^2}$

$dv = x^3\,dx$

$v = \frac{x^4}{4}$

$$= \frac{x^4}{4}\arctan x - \frac{1}{4}\int \frac{x^4\,dx}{1+x^2}$$

$$x^4 - 1 + 1 = \frac{(x^4+1)(x^2-1)}{x^2+1} + \frac{1}{1+x^2}$$

$= \frac{x^4}{4} \arctan x - \frac{1}{4}\left(\int (x^2-1)\,dx + \int \frac{dx}{1+x^2}\right)$

$= \frac{x^4}{4} \arctan x - \frac{x^3}{12} + \frac{x}{4} - \frac{\arctan x}{4}$

Integration by Parts

(1) $\int x^n$ (arctan x, arc cot, arc sin, arc cos) dx $(x^n\,dx = dv)$

(2) $\int e^{ax} x^n\,dx = \int k^x x^n\,dx$

$[(k = e^{\log k})$ by def of logarithm

$k^x = e^{x \log k}]$

$= \int e^{x \log k} x^n\,dx$

6.6.50

$$\int \underbrace{(\log x)^n}_{u} \underbrace{x^m}_{dv} dx$$

$u = \log x^n$

$du = n(\log x)^{n-1} \left(\frac{dx}{x}\right)$ (derivative of $\log x$)

$dv = x^m dx$

$v = \frac{x^{m+1}}{m+1}$

$$x^{m+1}(\log x)^n - \frac{n}{m+1}\int \frac{x^{m+1}(\log x)^{n-1} dx}{x}$$

3(a) $I = \int (\log x)^n x^m dx$

$\log x = y$

$x = e^y$

$dx = e^y dy$

$I = \int y^n e^{my} e^y dy$

5.7.19

$$\int e^{ax} x^n \, dx$$

$$\begin{cases} u = x^n \; ; \; du = n x^{n-1} dx \\ dv = e^{ax} dx \; ; \; v = \dfrac{e^{ax}}{a} \end{cases}$$

$$= x^n \cdot \frac{e^{ax}}{a} - \frac{n}{a} \int e^{ax} x^{n-1} dx$$

---

positive integers; if negative → go

(3) $\int (\log x)^n \cdot x^m$

$\int \frac{e^x}{x} dx$ (integration by parts won't help)

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

substitute

$$\int \frac{1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \cdots}{x} dx$$

p. 39 & 40 table see
improved technology
Coke
Cement – also due to larger & more efficient units

Compared with other industries ch. E. has higher capital ratio
.71 for 1919 for all industries
// wages salary & raw material
19% for wage ratio in ch. E.
& 5% for salaries.
Wage ratio ½ for wages to ½ for products
Material ratio – almost as important as capital ratio.
Markets fluctuate & it pays to buy on a favorable market in large amount of raw material but not too great an excess.
Where material ratio of industry is high buying is a more important

65-4311-1B-13 (12)

65-43077

Ex 223

SAC, Philadelphia 7/10/50

SA T. SCOTT MILLER, JR.

HARRY GOLD, was.
ESPIONAGE - R

EXHIBIT 65-4307-1B-13 (12) (Exhibit 23)

On 6/22/50, GOLD advised that these cards are laboratory notes of BILL ROHOLL, an employee of ABRAHAM BROTHMAN, in connection with work on the methyl methacrylate molding powder process on which BROTHMAN was working.

TSM:HKF
65-4307

Methyl Methacrylate — Molding Powder

U.S. 2,171,765 Sept. 5, 1940 (Röhm & Haas)

Aq. suspension of a finely divided polymeric methacrylic ester and an amt. of monomer at least 10 times as great as that of polymer is polymerized. Granular product.

(CA. 34:199)

Methyl Methacrylate

Fr. 847,879 June 20, 1939 duPont
US 2,161,461 June 6, 1939 ✓

MeMe or styrene, with catalyst is emulsified in H_2O and passed in a continuous manner and in a turbulent flow through a curved tube which is heated at a temp. high enough to effect the polymerization when it passes the heated zone. Examples of emulsifying agents and

Plasticizers (eg diamyl phthalate) given

CMC 6-7-50

(CA. 34: 8858)

Methyl Methacrylate

Fr. 841, 849 June 20, 1929
U.S. 2,161,461 June 6, 1939 Bm Works (duPont)

Apparatus and process for preparing a dispersion of methacrylate emulsion flows in a state of turbulent agitation through a heated tube for a time sufficient to effect polymerization.

Equipt might be adapted for powder finder

CA 33: 7317

Example 1:

	Parts
MeMe	1200
water	600.
Sodium Lauryl Sulfate BP	15 dissolved in 1/2
	1.5 dissolved in 7.5 in water
H_2O_2 (20%)	33. " " "

The mixture is passed through Colloid mill, and then ~~through~~ heated tubes.

Stable emulsion

Methyl Methacrylate — Molding Powder

(duPont)

US. 2,244,709 June 10, 1941 L.P. Hobbach

A product suitable for molding is prepared by subjecting to polymerizing conditions a mixture comp. methacrylic acid together with 2-20 times its quantity of Me Me.

(CA. 35: 6075[9])

Methyl Methacrylate

U.S. 2,123,757 Oct. 11, 1929 D.E. Strain (duPont)

MeMe polymerized in granular form by disgersing MeMe (5 part) in water (25 part) containing about 0.3 part of a gel-like resin obtained by polymerizing the product of the reaction bet. MeMe and aqua NH_3, and subsequently polymerizing the disgersion while ~~stirring~~.

Methyl Methacrylate

US. 2117.371 May 17, 1938 R. Hill (ImpChem. Ind.)

Products suitable for molding or for uniting sheets of glass are formed by polymerization of MeMe and at least one other unsat. polymerizable ester (e.g. vinyl acetate). (No emulsion — product pale yellow)

C.A. 32: 5111

Methyl Methacrylate

U.S. 2,121,839 June 28, 1938 D.F. Strain (duPont)

A fluffy powder prepared by dissolving mon. in H_2O-MeOH (77% mon.) and polymg. More polymer is precipitated in fibrous form. Polymer is separated and monomer adhering to polymer is removed. Powder suitable for molding and for lacquers.

C.A. 33: 6366

Methyl Methacrylate — Molding Powder

Fr. 844,091 July 18, 1939 - Imperial Chem. Ind.

Granular dispersions prepared by heating at 80°C under agitation by using MeMe 30 parts, water 100 pts and 0.3 parts of the persulfates of Ca, Mg, Ba. Persulfates of Li, Na, K, and NH_4 produce stable emulsions.

Example 2:

Me Me monomer	30 parts
dibutyl phthalate	20 "
Water	100 "
Li persulfate	1 "

Stirred vigorously at 80°C. After ½ hr. temp. rose to 90-95°

Stable emulsion

dec. 5-9-9

Example 3:

Me Me	33 parts
Water	66 "
Na persulfate	0.7 "

Spherical granules

Methyl Methacrylate

Brit 471,755 Sept. 9, 1937. du Pont

Granular polymer prepd from MM by subjecting it to kneading operation at a sufficiently high to induce polymerization. Polymerization catalyst, fillers, plasticizers, modifying agents (eg. Lexene, H_2O, EtOH, MeOH). Example: MeMe polymerized with or without (1) Bz_2O_2, (2) Stearic acid, (3) Bz_2O_2 and

diethoxyethyl phthalates; and (3) α-ethyl
(2) and (1)

ae
5-9-9

CA. 32:1262

Methyl Methacrylate Molding Powder

Br. 437,784 Oct. 28, 1935 du Pont

MeMe is polymerized in soln. in a mixture of H_2O and H_2O-miscible org. solvent, the amount of H_2O being substantially such that further addn. would ppt. monomer at the temp. of polymerization.

[CA. 30: P7794]

Example: MeMe is introduced through one inlet and mix. of MeOH and H_2O through another inlet into a steam-jacketed kettle provided with a stirrer. The mixture is heated to 65°C. and samples taken to determine when appr. of polymer begins, when fresh MeMe is introduced to preserve the correct compos. of reaction mixture. Polymer is separated and dried.

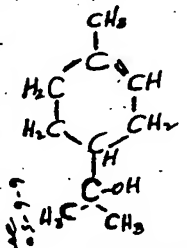
use 5,9-9

Methyl Methacrylate — Molding Powder

U.S. 2,101,395 May 21, 1940. D.A. Fletcher to Du Pont

MeMe molding material is prepared by mixing monomer with 3-14% its quantity of α-terpineol and subjecting the mixt. to polymerization conditions.

(CA. 34: 6365)



Colorless solid
m.p. ~~121°~~ 38-40°C
Odor of lilacs

α-Terpineol

Methyl Methacrylate

Br. 548,727 Oct. 7, 1942 The British Thompson-Houston Co,

A water-sol. salt for use as a granulating agent in prep'g synthetic resins fr. MeMe is prepared by subjecting to alk. hydrolysis, polymerized alkyl ester of itaconic, fumaric, mesaconic, citraconic or aconitic acids. (CA. 37: 6374)

$HOOCCH_2C(=CH_2)-COOH$ Itaconic Acid

$HOOC-CH=CH-COOH$ Fumaric Acid

MP >287°

Sol. in water

use 0.5.9

√ Methyl Methacrylate — Molding Powder

U.S. 2,265,247 Dec. 9, 1941 B. M. Marks (duPont)

A granular polymer of MeMe having adsorbed thereon a polymeric acrylic or alkyl acrylic acid is treated with an aq. soln of an alk phosphate, then washed with H_2O until free from salt.

(CA. 36: 2046)

Methyl Methacrylate.

U.S. 2,296,403 Sept. 22, 1942 Renfrew & Gates (Imp. Chem. Ind.)

MeMe dispersed in an aq. vehicle in the presence of metal or alk. earth metal persulfate as a dispersing agent with more of the compound than that which is soluble in the vehicle under prevailing conditions.

(CA. 37: 1211.)

Methyl Methacrylate Molding Powder

U.S. 2,326,326 Aug. 10, 1943 J. Breedis (R+H)

Moldable methacrylic resin prepared by injecting directly into water maintained at about 90-175°C, MeMe through an orifice (0.5 mm D), so as to cause the injected material to form as particles of such small cross section that they are heated

to the temp. of the water and then polymerized in a fewsec.

6.6.50

(CA. 38: 799)

Methyl Methacrylate Powder

Br. 395,687 July 17, 1933 R. Holl

Articles are manufactured by thermoplastic molding of product obtainable by polymerization in presence of diluent. Plasticizers: Camphor, triacresyl phosphate. Polymerization: (1) 0°C. → 100°C (2) K_2O & $NaBO_3$ → 60°C. (3) Mixing with titanium white & china clay.

[CA. 28: 591]

ace
15-7-9

[illegible]

Methyl Methacrylate

Ger. 735,784 Apr. 8, 1943 · Röhm & Haas

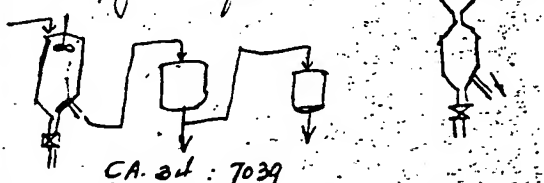
Mon. acrylates, methacrylates, and vinylates are mechanically emulsified without using emulsifiers, in an aq. suspension of powdered substances insol. in the monomers or in H_2O. The emulsion is then polymerized.

(CA. 38: 3770)

Fr. 844,073 July 18, 1939 I.G. Farben

Continuous polymerization of org. compds. in aq. emulsions lighter than water consists in using high liquid columns, introducing the org. compd. and emulsion liquid at the top, and evacuating the dispersion of the polymerized products through the bottom; the liquid rising

agitated only at the tops.
discussed vinyl chloride
Emulsifying agent:
Sod. α- oxy. octodecane sulfonate
Sod, persulfate



CA. 2nd : 7039

✓

US. 2,163,305 June 20, 1939 Harry R. Dittmar du Pont

A starch is used as a dispersing agent in the polymerization of acrylic acid or methacrylic acid or esters of these, and is then removed as by use of pancreatin and HCl soln and washing. Procedure given

CA 33: 7931

modified starch
O.R. Kreimeier & R.W. Maxwell
Patent U.S.

Dec 6-51

50% with styrene produces a tougher article than with 85% S.

Example 3 A mix of 25 parts styrene, 1 part 50%, and 100 parts of water were heated with stirring at 90-100°C under reflux for 24 hrs. Product washed with ethyl alc. and dried.

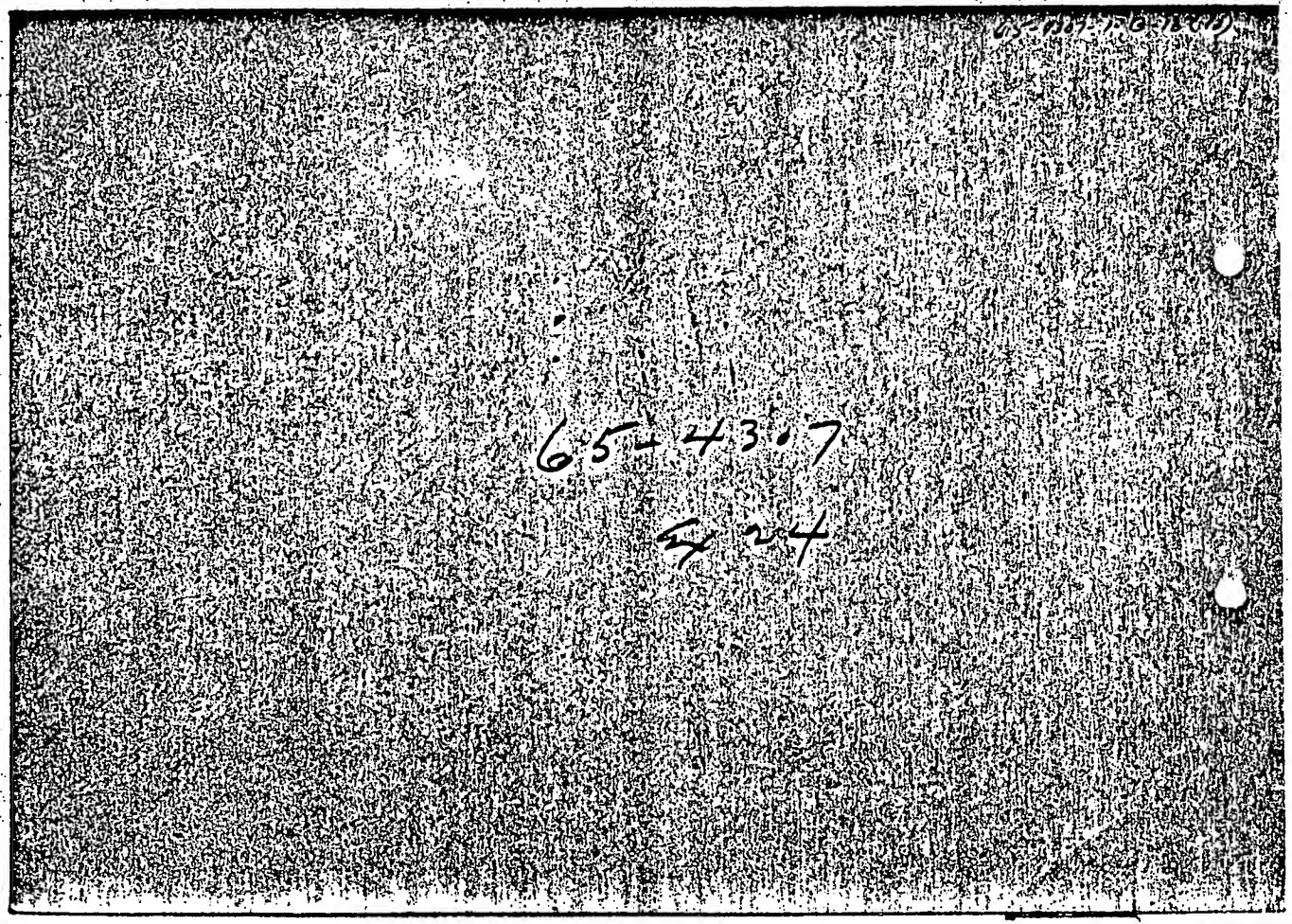
Example 4: A mix of 15 parts styrene, 6 parts methyl meth., 1 part 50% and 400 part water in a flask with reflux condenser & stirrer, was heated with vigorous stirring under gentle reflux for 9 hrs. Some of the powder remained in suspension some acid was added to settle the suspen-

Styrene

Br. 511,417 Aug 18, 1939 duPont

Styrene, or a mix. of styrene and MeMe is dispersed or dissolved in a liquid medium is polymerized in the presence of Br as a catalyst

CA 34: 1860


65-43.7
5224

SAC, Philadelphia 7/10/50

SA T. SCOTT MILLER, JR.

HARRY GOLD, was.
ESPIONAGE - R

EXHIBIT 65-4307-1B-13 (13) (Exhibit 24)

On 6/22/50, GOLD stated that the name JAMES A. DEVLIN was that of an assistant in the laboratory at St. Joseph's College. GOLD stated that he was a day school student and was Father MALLOY's assistant and worked in the laboratory at night. GOLD stated that he met DEVLIN at the Franklin Institute and apparently DEVLIN had written his name and address on the back of a Franklin Institute call slip.

TSM:HKF
65-4307

James A. Devlin
6238 N. 4th St.,
Phila. 20,
Penna.
HA4-1078

65-4302-1-B-13 (14)

Date Received 6/6/50

From _____
(Name of Contributor)

_____
(Address of Contributor)

By James J. Bunyan
(Name of Special Agent)

To be returned Yes [ ]
No [ ]

In connection with James J. Bunyan

File No. 65-43077-1-B-13 (114)

6/6/50 Started 4:25 pm 65-4307

articles and items located and removed from premises of Joe Gold 6823 Kindred St, Phila, Pa

1 manila folder 12A

One fourth shelf of wooden cabinet in front of basement

One hundred 8 3/8" x 10 9/16" sheets of paper pertaining to answers to advertisement for position of employment giving Harry Gold's background, education and experience in the field of chemistry

Eight applications for Federal employment U.S. Civil Service Commission announcement for examination in field of chemistry

found by FBI

1 manila folder 12B

One fourth shelf of wooden cabinet

Eighty two 8 1/2" x 11" sheets of paper containing chemical formulae and notes on experimentation concerning lactide, butyl acetate etc.

found by FBI

6/6/50 65-4307

On fourth shelf of wooden cabinet

Twenty two 8 3/8" X 10 15/16" sheets of paper containing chemical formulae and notations or representation with also a white sheet of paper 7 7/8" X 4 15/16" attached to one of these yellow sheets. On one of these yellow sheets the words are contained On Ilozarisir's method:

Zakharova - Sci Reports Leningrad State Univ

Seven 4 15/16" X 7 7/8" red sheets relating to "Lab. organization, Lab Work, monomer portions and proper monomer

Photostatic copy of U.S Patent Office Document # 2,317,138 concerning granular polymerization of ethenoid monomer

Photostatic copy of document bearing number 444,257 relating to Plastic Materials and Methods of Production

Photostatic copy of document bearing number 504,734 concerning Improvements in or relating to the Manufacture of Methacrylic Acid Esters

Seven sheets of white paper 8 1/2" X 11" pertaining to Nylon and containing chemical formulae

One 8 1/2" X 11" sheet of grand paper containing chemical formulae

1 in Case Marked Folder 12

6-6-50 65-4307

In One Manila Folder 12C

(continuation of contents of Manila Folder 12C)
One yellow sheet 8½" x 11" containing notation "Tare or manometer"
Three yellow sheets of paper 7 15/16" x 12½" containing notation Nylon CA 1945 and reflecting information concerning processes
Two white sheets of paper 4 7/8" x 7 15/16" relating to chemical experimentation found by FBI

In One Manila Folder 12D

One fourth shelf of wooden cabinet
Four sheets of white paper 8½" x 10 15/16"
Three of which bore notation "Am OH - Hexine Run" and the fourth sheet notation "Theory"
Letter on stationery of American Cyanamid Co dated 7/16/47 addressed A Brotherman + Associates concerning submission of sample of Special Wax #1111
Leaflet of Scientific Glass Apparatus Co, Inc, Bloomfield N J re "The Improved Heating Jacket"
Booklet of Hendrick Mfg Co re "Hendrick Mixing Equipment"

6-6-50 65-4307

(continuation of contents of Manila Folder 12 D)

Leaflet captioned "Precise Fractionation Assembly Used by the National Bureau of Standards" distributed by The Emil Greiner Co, N.Y.C.

Leaflet of The Emil Greiner Co, N.Y.C re Cartesian Manostat.

Leaflet of The Emil Greiner Co, N.Y.C re Stainless Steel Weights

Pages 217 and 218 Chemical & Metallurgical Engineering issue Jan. 1946 - Page 217 concerns Heat Transfer Equipment

Pages 219 and 220 Chemical & Metallurgical Engineering issue Jan 1946 - Page 219 concerns General Chemical Co - Supply Line for American Industry

One white sheet of paper 8 1/2" X 11" with notation "Conditions" and containing diagram found by FBI

from Manila Folder 12 D

on fourth shelf of wooden cabinet

Thirty seven sheets of white paper 8 1/2" X 11" which bear the dates of Feb. March, April and May 1947 some of which are captioned "Esterification with P_2O_5" and pertain to experimentation, test chemical process found by FBI

from Manila Folder 12 E

6-6-50 65-4307

1 Ex One Manila Folder 12 F

One fourth shelf of wooden cabinet
One white sheet of paper containing caption "Continuation Sheet No 1" with sub caption "Item 16 Experiment pertaining to Harry Gold
Three sheets of blank white paper 8 1/2" X 11" found by FBI

1 Ex One Manila Folder 12 G

One fourth shelf of wooden cabinet
Sixteen sheets of white paper 8 7/16" X 10 15/16" captioned "appl 21 The Oxidation of derivatives of Acetylenic Alcohols and Glycols"
Thirteen sheets of white paper 8 7/16" X 10 15/16" captioned "appl 21 The Oxidation of Acetylenic Alcohols and Glycols"
Eleven sheets of white paper 8 7/16" X 10 15/16" captioned Appl 6 Synthesis of Acrylic monomers
These pieces of papers were clipped together the sixteen sheets in one group, the thirteen in another group and the eleven in another group found by FBI

-6-

6-6-50 65-4307

In one manila folder 12 H

On fourth shelf of wooden cabinet

One two page letter dated 2/21/47 on the stationery of Pennie, Edmonds, Morton and Barrows Counsellors at Law, NYC addressed to Mr Abraham Brothman signed Arnold R Workman referring to Brothman's patent data relating to the process of manufacturing methyl methacrylate monomer - On Page 2 it is reflected that Russian literature citations were not used against the Vaughn patent.

Letter dated 1/7/47 on the stationery of American Cyanamid Co, NYC addressed to A Brothman and Associates signed E J Tuthill, Synthetic Organic Chemicals Dept. referring to Brothman's interest in Ammonium Metavanadate, and a shipment of the same.

A sheet of white paper 8 1/2" X 10 5/16" containing several numbers, the numbers "0.453 X 454 = 206 grams" is at top of page

Three sheets of white paper with captions "Seminar 1", "Lab vs Office" "Lecturer Preparation"

found by JOD

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On fourth shelf of wooden cabinet

Three sheets of white paper 8 1/2" X 11" with captions "Polymer in higher Ketone solv - than steam distil Ketone," also "Particle shape," and "Surface Theory"

One white sheet of paper 8 1/2" X 11" with inked notations - first line reads "Sample bottle full = 346.6 gms.

One white sheet of paper 4 5/16" X 7 5/16" - first line reads "Diethylene Glycol monolaurate" and word "Glaurin" appears on second line

Two sheets of white paper with captions "Program for Mr Mc Bowler Work" and inked notations

I Removal of Adhered (?) Gum Arabic Film

II Use of Emulsifying Agents Requiring Smaller Amounts than Gum Arabic

III Use of Diallyl Phthalate Polymers as a Dispersing Agent

IV Emulsification in a Alkaline Medium

1 envelope 12 Items

6-6-50 -8-

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(Continuation of contents of Manila Folder 12 I)

Reprint from India Rubber World, June 1944 of article entitled "Polymerization of Vinyl Derivatives in Suspension" by W P Hohenstein, F Virgiello and H Mark Polytechnic Institute of Brooklyn. This article reprinted with compliments of The Whiting Blake Company, New Haven, Conn.

Reprint from India Rubber World, January 1945 of article entitled "The Formation of Vinyl Polymers in Emulsions and in Suspension" by S. Siggia, W P Hohenstein and H. Mark Polytechnic Institute of Brooklyn

Photostatic copy of item from Industrial and Engineering Chemistry Vol 37 No 4 April 1945 entitled "Emulsion Polymerization of Acrylic Esters by W C Wast, Lee I Smith and C H Fisher, Eastern Regional Research Laboratory, U S Department of Agriculture, Philadelphia, Pa including pages 366 through 369

In Coal Industry Folder 12 H

6-6-50 65-4307

(Continuation of contents of Manila Folder 12I)

Seven sheets of white paper 8 1/2" X 11"
containing respective captions at top of page

U.S. 2,163,305 June 20, 1939 H. Rothrock (du Pont)
U S 2,201,395 May 21, 1940 W. A. Fletcher (du Pont)
U.S 2,244,702 June 10, 1941 L P Hobbuch (du Pont)
Br, 437,284 Oct 28, 1935 du Pont
U.S. 2,265,242 H Marks (du Pont)
U. S. 2,133,257 Oct 11, 1939 W. E. Strain (du Pont)
U.S. 2,171,765 Sept 5, 1940 Rohm + Haas

these relate respectively to

use of methyl methyl sterates involving ester
mixture of methyl methacrylate and distilled water
" " distilled water and methyl methacrylate
solution prepared from methyl methacrylate, water and methanol
polymethacrylic acid as a granulating agent
solution of water soluble polymethacrylamide
colloidal suspension of aluminum hydroxide

Twenty-nine sheet of yellow paper with pencilled
writing and one blue piece of yellow paper 8 1/2" X 11 1/8"
some of these pages pertain to methylation of

Manila Folder 12I

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(continuation of contents of Manila Folder 12 I)

starch, ethoxy-methylene-malonic dinitrile, ethyl orthoformate, Liebig's annalen der Chemie, possible modification in vitamin synthesis, Ribroplavin, Vitamin C (L-ascorbic acid)
One sheet of white paper first line reads "2,071,250 (next numbers and words not completely discernible). this sheet 8½" x 11"
One sheet of yellow paper 8 5/16" x 11" dated 9/25/46 first line reads "Run diethyl Phthalate Polymer for Reaction Time" contains notation "Russian Job Wyatt Toner"
One blank piece of paper 8 5/16 x 10 7/8"
Two sheets of white paper 8½" x 11" captioned "a new Way of Using CaC_2"
White sheet of paper 8½" x 11" with inked notations concerning metal reflector in prism box of abbe refractometer - name Mr. Wayne
UB 9863 also on this sheet of paper
found by HB

In one manila folder 12 I

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On fourth shelf of wooden cabinet
Two sheets of white paper containing pencilled notations and one sheet of blank white paper 8½" x 11" - one piece of paper has caption "Distillation" - second piece of paper contains notation which appears to be $5\ V_2$ - 1 Hexine
Ten pieces of white paper 5½" x 8½" stapled together with stamped date of Nov 29 1946 appearing on first page and pencilled notation of dates 12-2-46 and 12-3-46 on subsequent pages notations on pages referring to Hexine and Ketone possibly refers to experimentation
One piece of yellow paper 5½" x 8 7/16" refers to mixture of benzene and HOH (water)
One piece of white paper 3 15/16" x 5 15/16" with diagram of butane and acid
Four pieces of white paper 5½" x 8½" with notation on first page 12-6-46 and "butane by Kazarian's method" and

12 and Numbers Labeled 12 JT

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(continuation of contents of Manila Folder 12 J)

For Manila Folder 12 J

dates 12/6 and 12/6/46 on succeeding pages
Nineteen sheets of white paper 5 1/2" X 8 1/2"
stapled together - penciled notation of
date on first page "12-5-46" and on some
of succeeding pages and stamped date
and penciled date 12-16-46 on other pages -
thirteen of above mentioned pages blank
and from penciled notations appearing
thereon - first page has notation wt.
of KOH, acetone, third page has
notation hydrolysis of 1st fine.
Nine sheets of white paper 5 1/2" X 8 1/2"
contain reference ether solution, distillation
and ether distillation - other sheets
have date of 12-23-46 and 12-26-46
appearing at tops of some of the pages
and also the notations C-23 + C 24
Four sheets of white paper 4 5/16" X 7 5/16"
containing chemical formulae

6-6-50 65-4307

(continuation of contents of Manila Folder 12 J)

In one Manila Folder 12 J

Blank piece of white paper 8 7/16" X 10 15/16"

One sheet of white paper " " "

Containing notations C 35-22 gm. 19 cc on top line

One sheet of white paper 8 7/16" X 8 1/16" with mathematical equations and "saturation line" curves

Three sheets of white paper 5 1/2" X 8 1/2" On first page notations 1) Absorber 3) Kagerian X Today's run 3) Bender - on second page percentage figures and stamped date Nov 27, 1946 appears - on third page notation 297 cms KOH appears on further nineteen sheets of white paper 5 1/2" X 8 1/2" eight of these pages are blank - penciled notations on other pages refer to methyl, hydroxy, butene, acetone, butene synthesis dates appearing at top of page 12-9-46, 12-10-46 12-11-46, 12-12-46 - these pages stapled together

6-6-60 65-4307

(continuation of contents of Manila folder 12-J)

In one Manila folder 12-J

Twenty three sheets of white paper 5 1/2" X 8 1/2" four of these sheets are blank - all twenty three sheets stapled together - date appearing at tops of pages includes 12-17-46, 12-8-46 and 12-20- notation C-21 appears at top of one page - references on these pages to acetone, distillation

Seven sheets of white paper 8 1/2" X 10 15/16" with mathematical equations appearing thereon

Four sheets of yellow paper 8 1/2" X 11" two of which have notations at top "Class I" and "Class II" - these pages refer to heptine and butene ~~oxide~~ also to oxidation of carbinols to isobutyric acid molecule

Two sheets of white paper 4 15/16" X 7 15/16" first page contains mathematical equations second page references to Acetone, Butene Heptine

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(continuation of contents of manila folder 12 J)

In one manila folder 12 J

One sheet of white paper 8 1/2" X 10 5/16" containing chemical formula - word "reaction" at top of left hand corner on one side of this sheet of paper - name "Mr Dougherty" C O 7-2119 at top of left hand corner same side of paper

One sheet of white paper 8 1/2" X 11" notations May, Urbick, Brandish, N E 9-2302 appear at top of page on one side - on reverse side at top left hand corner "A. Brothon" appears

One sheet of white paper 8 1/2" X 10 7/8" on stationery of A Brothon and Associates - notation at top of page refers to filtration on Buchner funnel with dry-ice acetone trap to vacuum line - at lower left of page "C O 7-2119 after 1° or before 12" appears at lower left of page

One sheet of white paper 8 1/2" X 11" containing chemical formulae

One sheet of white paper 8 1/2" X 11" captioned Ex periment 1-7-47 relating to 270 g of methylol added to 110 g KOH.

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(Continuation of contents of Manila Folder 12 J)

In one Manila Folder 12 J

One sheet of white paper dated 11-4-46 relating to experiment - page 8 3/8" x 11"

One sheet of white paper 8 3/8" x 11" - first line reads 25g Monomer

One sheet of white paper 8 1/2" x 10 15/16" - first line reads make set-up as per Expt. C 33 (water traps for methylol) - reverse side has notation Call Mr Bronstein Armory 4-6520

One sheet of white paper 8 3/8" x 11" containing chemical formulas - on one side of page other extractions mentioned - on reverse side notation agenda 6th Ave + 42 nd Bryan 18th Jewelers 1095 6th Ave Sears in Pa

Ten sheets of yellow paper clipped together 8 7/16" x 10 5/16" captioned J Gen Chem 4 1347-52 (1934) New Method of Applying Calcium Carbide

Sixteen Pages of white paper 8 1/2" x 11" containing chemical formulas

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(continuation of contents of Manila Folder 125)

Found on Manila Folder 125

Two sheets of white paper 8 1/2" X 11" - one sheet bears caption 'Conference 3-11-47' and has sub captions monomer synthesis powder polymerization and sheet on bulk polymerization - second sheet has date 3-11-47 appearing on it and contains chemical formulas

One white sheet of paper 4 5/16" X 7 5/16" has notation at top USSR 11

1111 - 20 (1941)

found by JHD

Found on fourth shelf of wooden cabinet

Found on Manila Folder 12 K

One sheet of white paper 8 7/16 X 10 5/16" containing diagram and chemical terms

Two sheets of white paper 8 1/2" X 11" one sheet contains notation - titration in alcohol second sheet " " " Mila's Work

Tertiary Butyl Hydroperoxide

Tablet of four unsheets of white paper - only three which contain any writing - this consists of numbers and chemical terms

6-6-60 65-4307

(continuation of contents of Manila Folder 12K)

In one Manila Folder 12K

One sheet of lined paper 8 1/2" X 11" containing numbers and chemical terms found by Gay

In one Manila Folder 12L

Found on fourth shelf of wooden cabinet

Five sheets of white paper 8 1/2" X 11" containing chemical formulas and note on esterification

Two sheets of white paper reporting chemical esterification - three pages stapled together

Two sheets of white paper 4 5/16" X 7 5/16"

One page has notation CA 29, 3926

Second page " " Bistet Kamelsk 1936 (9) 12

Four sheets of white paper 8 1/2" X 11" containing chemical formulas + experimental notes

Two sheets of white paper 8 1/2" X 11" containing chemical formulas

Sheet of graph paper containing caption solubility - GFW PER 1000 g H_2O

One sheet of white paper dated 6-9-47 captioned Vanishing Cream Formulas

6.6.50 65.43.7

(continuation of contents of Manila Folder 12L)

In One Manila Folder 12L

Two sheets of paper of a Brothman and Associates - first page contains caption Scientific Glass - the first line of second page begins "3 only # 5.732

One sheet of paper with steam of a Brothman and Associates relating to the manufacture of Thioglycolic Acid (6.20.47)

One sheet of white paper 5 9/16" x 8 1/2" captioned "VC Formulation"

One typewritten sheet dated 8.21.46 captioned The Preparation of Urea Formaldehyde Cold-Setting Glue

One sheet of paper of a Brothman & Associates first line reads Satisfactory Monomeric Mixture found by JDS

From Manila Folder 12M

Found on fourth shelf of wooden cabinet

Three sheets of white paper dated 3.10.48 referring to Organolysis of Dimethyl Thiazine Diol and Organolysis of Methyl Butenol found by JDS

6-6-50 65-4307

Found on fourth shelf of wooden cabinet Manila folder labeled Patent Literature Search on Methyl Methacrylate.

One sheet of paper on G Brothman and Associates stationery which is captioned Improved Mc Mc Monomer Synthesis

Nine sheets of lined paper dated 7-25-46, 4-9-46, 4-15-46 and 4-24-46 These are captioned Mc Mc Molding Powder, Preparation of Peta, Recrystallization of Peta from Acetone - last page appears to be stenographic notes

Four sheet of paper clipped together dated 5-2-47 captioned The Synthesis of 2, 5 Dimethyl - 2, 5 Dihydroxy - Hexine 3

One white sheet of paper 8 1/2" X 11" middle of page contains notation Ser 668,870 Dec 12, 1938 Walhelm Reich

One sheet of graph paper containing notation dish, water, methylal

Found on fourth shelf of wooden cabinet Manila folder labeled Patent Literature Search on Methyl Methacrylate.

6-6-60 65-4307

(Continuation of contents of manila Folder 12N)

Two typewritten pages containing sub-captions methyl-butenolone, vapor phase esterification, methyl ester, chloroform, methoxy-isobutyric acid, methyl methoxy-isobutyrate and catalytic de-alkoxylation - date Dec 14, 1946 appears at bottom of second page

One sheet of yellow paper 8 9/16" x 10 15/16" containing chemical formulae

found by JOD

(margin, bracketing the above:) In one manila folder 12N

On fourth shelf of wooden cabinet

One sheet of white paper captions mold, Wt. of Me Me, In 80-85° oven and Low temp oven over four columns

One sheet of paper captioned Castings

One sheet of paper " Physical-Test Specimens

One sheet of paper captioned 3/16" sheets

found by JOD

(margin, bracketing the above:) In one manila folder 12O

6-6-50 65-4307

In brown manila folder 12 P

Found on fourth shelf of wooden cabinet
One sheet of paper 8 1/2" X 11" first
line of which reads 2,4 Dichloro Benzaldehyde
notation in middle of page on this sheet
U S Tariff Comm Wash D C
Four sheets of paper dated 4-3-47
captioned UC relating to UC for
sun and wind burn
found by FBI

In one manila folder 12 P

Found on fourth shelf of wooden cabinet
Two typewritten copies, three pages in length, of a
"Report of Plate Coating Tests on Modified R-21 Dope"
These copies were identical in content with the ex-
ception that the date Oct 3, 1932 appeared on one
copy but no date appeared on the other. Under
a sub caption "discussion of Results" it was
reflected in the past year (possibly 1931) a
method had been found by which all methyl
alcohol soluble nitrocelluloses could be made
with a yield which, in small experiments,

(Continuation of contents on Memo Folder 12Q)

compares favorably with those obtained with P.R. and R.P types.

Seven graphs captioned as follows

Electrometric Titration of 1.73% Kodak Pack Experimental Gelatin 50-366.

Electrometric Titration of 1.76% # 26707 First run calf skin Gelatin

Electrometric Titration of 1.74% # 1581 Deionized Acid Pig Skin Gelatin

Electrometric Titration of 1.7% # 17912 Deionized Pig Skin Gelatin

Electrometric Titration of 1.73% Bone Stock (Allenville) gelatin

Electrometric Titration of 1.72% # 5351 Enzyme Gelatin

Electrometric Titration of Stress Blended Gelatin #1164

A two page document captioned: Method of operating machine above the Upper

for one Invention Folder 12Q

6-6-50 (Continuation of Contents of Manila Folder 12Q) 65-4307

In one manila folder 12Q

Explosive Limit, July 27, 1933, and signed Harold W Crouch. Attached to this document was a graph captioned: CO_2 - Acetone - Air Graph for Thermal Conductivity Cells, Cell Jacket Temp. 98.8 - 99°C, Cell Current 280 M.A.

A two page copy of the minutes of meeting dated Change to low viscosity Lintara for R. P. Cotton dated September 27, 1933. The minutes were signed by E. K. Barker, Department of Manufacturing Experiments.

A photostatic copy, four pages in length, of report number V 1.185 captioned: Report on Improved "Kodatrace" by R. Lenducci, Vincennes Factory, dated March 21, 1935. (Kodak Pathe, Vincennes, France.

Attached to this photostat was a diagram captioned Installation Required for Coating of Improved Kodatrace.

A two page typewritten copy dated November 25, 1935 captioned Proposed Change and Wind Ups for Machines Located in Building 20.

6-6-60 65-4307

(Continuation of Contents of Manila Folder 12a)

A six page typewritten copy captioned Chemical Plant, Kodak Park, dated December 19, 1935, on the subject Analysis of Solvent Mixtures of Butyl Alcohol, Ethylene Dichloride, and Propylene Dichloride.

A three page typewritten item dated November 12, 1935, captioned Conference for Discussion of Location vs Tendency Rights for R.C. Machines - November 12, 1935.

A two page typewritten copy of the minutes for a sub-Conference dated November 29, 1935 signed D. S. Babcock

A three page typewritten document captioned The Sub Conference of October 2, 1936.

A two page typewritten document captioned Sub Conference of October 16, 1936

A two page typewritten document captioned Sub Conference of October 23, 1936

A two page typewritten document captioned Sub Conference of October 30, 1936

In One Manila Folder 12a

6-6-50 65-43.7

(Continuation of contents of Manila Folder 12 Q)

From Manila Folder 12 Q

A two page typewritten document captioned
Sub-Conference November 6, 1936

A three page typewritten item captioned
Sub-Conference of November 13, 1936

A four page typewritten document captioned
Sub-Conference of November 20, 1936

A four page typewritten document captioned
Sub-Conference of November 27, 1936

Five page typewritten document captioned
Sub-Conference of December 4, 1936

Four page typewritten document captioned
Sub-Conference of December 11, 1936

Six page typewritten document captioned
Sub-Conference of December 18, 1936

Four page typewritten document captioned
Sub-Conference of January 8, 1937

Three pages typewritten document captioned
Sub Conference of January 15, 1937

Four page typewritten document captioned
Sub Conference of January 22, 1937

6-6-50 65-4307

(Continuation of contents of Manila Folder 12 Q)

In one Manila Folder 12 Q

A five page typewritten document captioned
Sub-Conference on February 5, 1937
Four page typewritten item captioned
Sub-Conference of February 12, 1937
Four page typewritten document captioned
Sub-Conference of February 19, 1937
Four page typewritten document captioned
Sub-Conference of February 26, 1937
Three page typewritten item captioned
Sub-Conference March 12, 1937
Four page typewritten document captioned
Sub-Conference of March 19, 1937
Seven page typewritten document captioned
Sub-Conference, Friday, April 2 and
Tuesday April 6, 1937
Four page typed document captioned
Sub-Conference of April 9, 1937
Five page typewritten document captioned
Sub-Conference of April 16, 1937

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(continuation of contents of Manila Folder 126)

In One Manila Folder 126

Three page typewritten document captioned
Sub-Conference of April 23, 1937

Three page typewritten document captioned
Sub-Conference of May 7, 1937

Three page typewritten document captioned
Sub-Conference of May 14, 1937

Three page typewritten document captioned
Conference May 21, 1937

Three page typewritten document captioned
Sub Conference May 28, 1937

Two page typewritten document captioned
Sub-Conference June 4, 1937

Two page typewritten document captioned
Sub-Conference June 11, 1937

Two page typewritten document captioned
Sub-Conference June 25, 1937

Five page typewritten document captioned
Status of Sub-Conference Matters
August 31, 1937

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(Continuation of contents of Manila Folder 12 G)

In One Manila Folder 12 G

Four page typewritten document captioned
Sub-Conference for September 10, 1937
Attached to this document was a page captioned
Average Brittleness Results on Safety X-ray
from 1934 to Present Time.
Three page typewritten document captioned
Sub-Conference of September 17, 1937
Four page typewritten document captioned
Sub-Conference of September 24, 1937
Four page typewritten document captioned
Sub-Conference of October 1, 1937
Three page typewritten document captioned
Sub-Conference of October 8, 1937
Three page typewritten document captioned
Sub-Conference of October 22, 1937
Four page typewritten document captioned
Sub-Conference of October 29, 1937
Two page typewritten document captioned
Sub-Conference of November 5, 1937

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(Continuation of contents of Manila Folder 12 Q)

In Manila Folder 12 Q

Two page typewritten document captioned
Sub-Conference November 12, 1937
Two page typewritten document captioned
Sub-Conference November 19, 1937
Two page typewritten document captioned
Sub-Conference December 3, 1937
Three page typewritten document captioned
Sub-Conference December 10, 1937
Three page typewritten document captioned
Sub-Conference December 17, 1937
Two page typewritten document captioned
Sub-Conference December 31, 1937
Three page typewritten document captioned
Sub Conference January 7, 1938
Two page typewritten document captioned
Sub-Conference January 14, 1938
Two page typewritten document captioned
Sub-Conference January 21, 1938
Three page typewritten document captioned
Sub-Conference January 28, 1938

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(Continuation of contents of Manila Folder 126)

In Manila Folder 126

Four page typewritten document captioned
Suit Conference February 4, 1938
Four page typewritten document captioned
Suit Conference February 11, 1938
Four page typewritten document captioned
Suit Conference February 18, 1938
Four page typewritten document captioned
Suit Conference February 25, 1938
Four page typewritten document captioned
Suit Conference March 4, 1938
Four page typewritten document captioned
Suit Conference March 11, 1938
Four page typewritten document captioned
Suit Conference April 1, 1938
Turned by JOD

In all of the documents captioned Suit Conference on the various above mentioned dates there were sub-captions dealing with chemicals and processes used in photographic work and by permutation

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Found on fourth shelf of wooden cabinet
Twenty eight sheets of white paper 8½" x 11" -
Only seven of these pages contain writing -
first page captioned Stoddard Solvent - et
and the succeeding pages contain chemical
formulae and mathematical equations
found by JDD

In one manila folder 12R

Found on fourth shelf of wooden cabinet
Six sheets of yellow paper 8½" x 11"
which contain chemical formulae and notes
on experimentation - these are enclosed
in a manila folder, which bears notation
on outside "Notes from Doc"
found by JDD

In one manila folder 12S

Found on fourth shelf of wooden cabinet
One sheet of white paper with caption Evaluation
of the new Unit for Absorbing CO_2
Blank sheet of white paper
Three typewritten pages concerning absorption
of CO_2 -

In one manila folder 12T

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Four sheets of paper - three yellow and one white clipped together - white page captioned "Outline of Report - first yellow sheet re Denver Flotation Equipment addressed to Doe from J Harry Gold and Joseph E P Bowman 2nd yellow sheet contains table of results 3rd " " captioned discussion of results Four blank pieces of paper Piece of white paper containing captions Latest Denver Unit, Turbo, Old Rest., Denver Twenty nine yellow sheets relating to tests and calculations concerning CO_2 - none of these sheets are blank Pages 283, 286 & 307 of the May 1941 issue of The Glass Industry containing article entitled "How to reduce the instability of vitamin content" - on Page 283 is pencilled notation Ronald, Dougherty, Harry Two typewritten sheets of paper dated 4/30/41 captioned Run #3 signed Harry Gold & Joseph E. P. Bowman

Gold Ronald Locke 1-17

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[redacted]

(Continuation of Contents of Manila Folder 12T)

In One Manila Folder 12T

Forty eight sheets of yellow paper

One page captioned "Use of the Denver Flotation Apparatus as an Absorber" – results of several runs in 1941 reflected,

Typewritten sheet headed Harry Gold June 30, 1938 captioned Recovery of CO_2 from Flue Gas

Nine typewritten sheets (four sheets) captioned "Use of The Turbo - Mixer As an Absorber Unless The Investment Cost of the Equipment Per Pound of CO_2 Is Known."

Drawing concerning some equipment (possibly containing diffusion of gas since gas meter is indicated on drawing.) Manila folder containing these documents captioned "CO_2 Recovery" found by FBI

In One Manila Folder 12U

Found on fourth shelf of wooden cabinet

One white sheet of paper captioned "Discussion 1. Mer Mar Sol

on reverse side is notation Rpt #3

CO - Recovery

[redacted]

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(Continuation of Contents of Manila Folder 12 U)

[Margin note: In one Manila Folder 12 U]

February 20, 1939 issue of the Industrial and Engineering Chemistry News Edition

February 10, 1939 issue of the Industrial and Engineering Chemistry News Edition

One sheet of white paper captioned Note on CO_2 Recovery # 2 with sub caption Data for a 1 ton Plant

Eighteen sheets of yellow paper with caption appearing at top Ethers, Acids, Cyanides & Nitro cpds. found by [illegible]

[Margin note: designated as Exhibit 13]

Found in fourth shelf of wooden cabinet

One hundred and forty miscellaneous sheets of paper described as follows:

Thirty one sheets of paper on stationery of A. Brothman & Associates relating to the subjects Vanillin, Chloroform from CCl_4 and Standardization of Molding Powder Tests — several of these sheets bear dates in 1947 and have notation by HG

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Conjugation of Ex-hibit 13

Three sheets of blue lined white paper addressed Dear Abe, one which starts in signed Harry and Phil, referring to the Stanton job being in a precarious state and indicating it would be impossible to develop a modification of the cyganbydin process in a few days as that Abe could demonstrate it in Switzerland

Eight pages of blue lined white paper captioned Charges - them pertained to lies concerning the Stanton job, personnel problems concerning Oscar, Phil, Harry, Bill, Bernie and Moskowitz

Seventeen blue lined yellow sheets captioned Preparation of Substituted Benzaldehydes

Eight pages of white paper dated 4-5-48 captioned Analytical methods for Tests of 316 ELC "Standers"

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Designation - Exhibit 13

One two page letter on stationery of Julian Paul Brodie dated Sept 13, 1946 addressed by Julian P. Brodie to A Brotherman refusing to agreement by Brotherman's organization to development servicing cream with expenses for such work being borne by Brodie and listing the other terms of this agreement

Typewritten page captioned "Program of Work For The Chinese Jot dated 8/26/46 Sixteen sheets of blue lined white paper some of which bear date of April 1948 containing chemical formulas notes on experimentation and one sheet referring to specific jobs apparently under consideration by A Brotherman + Associates

Twelve sheets of white paper some of which bear dates in May 1947 containing experimental notes in chemistry

Three sheets of blue lined bright yellow paper one of which contains chemical notations - the other two are written in French

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Fifteen sheets of blue lined yellow paper containing chemical experimental notes
Five sheets of red paper 3 15/16" X 6" bearing diagrams and chemical symbols
- one of these sheets contains name of Amron Corp 29 Bdwy, N Y C and the name of Mr Turner as person to call
Twenty sheets of white paper 4" X 6" containing chemical symbols and notes on experimentation
found by FBI

Identified as Exhibit 13

Found on kitchen shelf of wooden cabinet
One envelope postmarked Philadelphia, Pa June 2, 1948 addressed Harry Gold Elmhurst, N Y C bearing return address on reverse side of envelope Morrell C Dougherty 5517 Litchfield St Phila Pa
note enclosed in envelope from Doc to Harry states "I hope you get this in time see you soon"
found by FBI

Identified as Exhibit 14

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Bound on fourth shelf of wooden cabinet
Badger Corporation notebook - writing
first page of
on book refers to Patent of Jan 28, 1941
2,229,897 American Cyanamid Co -
succeeding pages refer to Analysis of
Ozone, hydroxy isobutyric acid,
esterification of 2-OH isobutyric acid,
keying synthesis - dates in this
book include Jan 23, 1946 to 3/25/47
- enclosed in this book were also eleven
sheets of blue lined yellow paper,
most of which bear date of September
1946, referring to chemical experimentation
found by JDD

Designated as Exhibit 15

Bound on fourth shelf of wooden cabinet
Two page photostatic copy of US Patent
office document # 2,030,901 concerning
Process for depolymerizing Alpha Substituted
Acrylic Acid Esters
found by JDD

Designated as Exhibit 16

Bound on fourth shelf of wooden cabinet
Two page photostatic copy of US Patent
office document # 2,359,212 concerning
Process for depolymerizing Polyglycerine
found by JDD

Designated as Exhibit 17

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designated Exhibit 18

Found on fourth shelf of wooden cabinet Federal Standard Stock Catalog L-P-406 Section IV part 5 - Federal Specification for Plastics, Organic; General Specification, Test Methods - catalog dated 1-24-44 found by JHD

designated Exhibit 19

Found on fourth shelf of wooden cabinet Envelope postmarked N Y C Nov 25, 1947 addressed to A Brotherman and Associates Long Island City, N Y bearing return address The Cooper Alloy Foundry Co, Hillside, N J - enclosed in envelope a twenty one page document captioned Memorandum for the Preparation of Thioglycolic Acid Patent Papers found by JHD

designated Exhibit 20

Found on fourth shelf of wooden cabinet Envelope postmarked Dec 3, 1947 Louisville Ky addressed to A Brotherman and Associates Elmhurst, Long Island bearing return address The Girdler Corp, Louisville, Ky - enclosed in envelope were eight pieces

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of white paper bearing date of November 1946 referring to chemical processes such as synthesis and degradation of acetylene - Glycols, Hydrogenation of acetylene hydrocarbons, reaction between O_2 and acetylene in the presence of Nitrogen oxides, oxalic acid from acetylene etc. - also enclosed in above envelope was letter dated 12/3/47 from J. C. Houghton Vice President of the Girdler Corp submitting several circulars and pieces of literature describing the Votator principle of heat transfer and processing and illustrating several models of Votator units (these enclosures still attached to letter)

also enclosed was Gold Medal Writing Tablet Book bearing name of Harry Gold

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- In this notebook are two pages dated 3-5-46 - one of these pages has as its first line "OsO_4 Ref. Mellor XV p 707," in the middle of this page is notation "1. OsO_4 not to influence rate of decomp. of alkali chlorates
- The second page has as its first line "MoO_3 Mellor XI p 545"
- Also in this notebook are four pages dated 4.20.47
first page, first line reads "Bull. de la Société Chemique 25, 346-364 (1901) and has subscription "Formation & decomp of Acetals -
second page, first line reads "methylal + 12% H_2O @ 14-26°C
third page, first line reads "J Phys. Chem. 36, 2325-2337 and has subscription decomposition of Methylal in Two phase

designate as St Rikis 20

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fourth page, first line reads Berichte 70, 1713-1719 (1937) and has sub caption Hydrolysis of Acetals

fifth page, first line reads Berichte 67, 424-429 (1934) and has sub caption Velocity of Acetal Hydrolysis

(all other pages of this notebook are blank)

Enclosed inside of this notebook is a piece of stationery of C Bistrzycki & Associates - in upper left hand corner on the date 11-2-47 and notation "14 dy" - beside the caption Dept is the name Mettler and beside the caption Subject is the writing $Ca(OCl)_2$ Process. In the body of this piece of stationery are the captions Sherman, Mathieson, Columbia also in the Binder Corp envelope are two pieces of yellow paper 4½"X5½", one of which is blank, and the other which has a formula reading "1 Use excess $Fe_2(SO_4)_3$ + add 11.0 slowly" [illegible] bound by [illegible]

Exhibit 20 identified by

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Found on fourth shelf of wooden cabinet
Envelope postmarked Oct 29, 1946 Phila Pa
addressed Harry Gold, Elmhurst, L.I., N.Y.
having return address Acheson Colloids
Corp. Phila Pa

Note on stationery of Acheson Colloids
Corp Port Huron, Mich addressed
to Harry from Leon which read
"Wish you luck - see you on the week-
end" - reverse side has chemical notation

Sheet of white paper 8 1/2" x 10 5/16", first
line reads "1 Variable Take-Off Still Head"

Sheet of white paper 8 1/2" x 10 5/16", first
line has notation V F Powell

Sheet of white paper 8 1/2" x 11", first
line reads "Solubility of p Dichlorobenzene 4"
with date 4-12-47 in upper right hand corner

One sheet of notebook paper 3 1/2" x 5 7/8"
first line reads "1. Vapor phase esterification
found by HG

Found on fourth shelf of wooden cabinet

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Designation Ex 22

Found on first shelf of wooden cabinet
Forty seven sheets of loose leaf paper
containing seven punch holes and bearing
penciled notations which pertain to
industries, chemical processes, inventions
and patents and German language notes
(There may be several note sheets some
are dated in 1932 and there two tabs
"Chem 107 and Gen 2")
found by FBI

Designation Ex 23

Found on second shelf of wooden cabinet
Twenty 3"x5" index cards "seventeen
of which pertain to Methyl Methacrylate
- molding powder with specifications
and uses for the same. Of the
three remaining cards, one is entitled
Styrene and the other two contain notations
concerning the use of methyl starch
as a dispersing agent and the continuous

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polymerization of org. compds in aq. emulsions
found by JOB

Found on second shelf of wooden cabinet
One 3 3/8" x 6" piece of white paper
containing following writing James
A Devlin 6238 N. 4th St Phila
20 Penna HA 4-1078
found by JOB

Search discontinued at 6:50 P.M.
JOB